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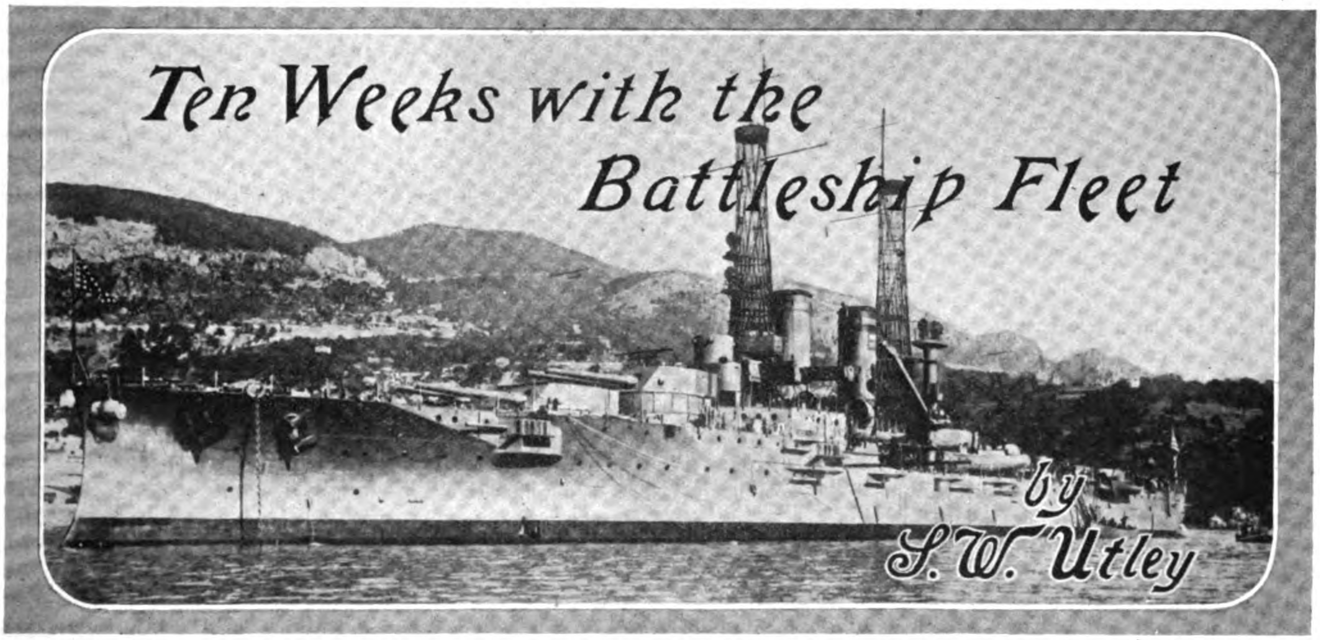


UNITED STATES BATTLESHIP UTAH AT VILLAFRANCHE

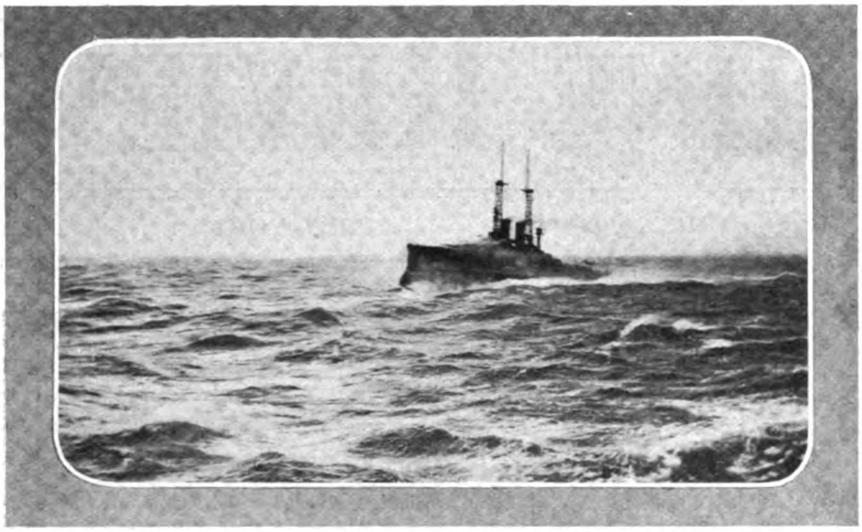
S. W. UTLEY,
Assistant Navigator,
U. S. S. Utah

IT IS seldom that a business man can step out from the lines in which his own work lies into the very heart of a great, but distinct profession, can be welcomed by those who are devoting their lives to it with all the cordiality of an equal, and can be made to feel that his efforts to do their work, no matter how far he may fall short of their own high attainment, entitle him to consideration as one of them. And yet, when I dropped my work as executive head of a large, steel plant one day last fall and became on the following day assistant navigator of one of our greatest battleships, I stood upon the threshold of an eight weeks' trip which was destined to be not only exceedingly interesting, but to afford an opportunity of seeing into the very heart of the navy officers' profession and of realizing the tremendous amount of misapprehension and misinformation that exists in the minds of the American people as to the lives of the officers and the men who are manning our fleets.

On October 23 last, Lieut. Rudd (junior officer in my own division) and I arrived in Hampton Roads bearing orders from the captain of the Michigan Naval Brigade to report to the commanding officer of the Atlantic fleet for assignment in connection with the cruise about to be made to the Mediterranean. By the time lunch was over, additional naval militia officers from Illinois, Wisconsin, Minnesota and Ohio had arrived and, accompanied by them, we boarded the flagship Wyoming and presented our orders to the admiral's chief of staff, who very quickly endorsed them, instructing us to report to commanding officers of the various ships for quarters and duty. As Commander Hughes handed our orders back to us and bade us good-bye, he remarked: "I hope you will have a pleasant time and a profitable one. I believe there are a good many things we can show you, and I know there are a great many you can show us. I have been the length of the Great Lakes on one of your ore carriers, and I know that when it comes to handling big ships in close quarters, no one in the world can equal your Great Lakes captains. Good-bye, and good luck to you."

Mr. S. W. Utley, Vice-Pres. and General Manager of the Detroit Steel Casting Co., is navigating officer of the Michigan naval militia with the rank of Lieutenant, and accepted the invitation of the navy department to take part in the cruise to the Mediterranean last fall, and in the spring of 1912 spent two weeks with the fleet at battle target practice. He will contribute a series of articles covering the impression made upon a business man by the active work of the fighting navy.

I had requested assignment to the U. S. S. Utah, in memory of the two weeks I spent aboard her at target practice two years ago, and in the knowledge that a good many of the men who had become my friends at that time were still aboard her. An hour after we had left the Wyoming, accompanied by Mr. Rudd, I found myself amid the old familiar surroundings upon her deck, shaking hands with some of my old friends and meeting those who were to be new ones; being assigned to quarters, and being made to feel thoroughly at home. In addition to the two of us from Detroit, the ship was to carry Lieut. Commander MacDonald, of the Ohio Reserve, and Lieut. Van Vleck,



THE FLORIDA PITCHING, SHOWING HER KEEL AND THE UNDERSIDE OF THE RAM

of the Maryland Reserve. After dinner was over the four of us went to the cabin to make our official call on Captain Van Duzer, who very graciously and with apparent sincerity, welcomed us to his ship and to his organization. On the following morning the executive officer detailed us to our various stations, Admiral Badger having insisted that all naval militia officers be treated not as passengers, but as men who desired to increase their knowledge by active work. It was worthy of note that great care was taken to see that we were assigned to work corresponding to our relative rank, and that in every way we were treated as officers in the regular service of a corresponding rank would be treated. I was greatly pleased to find that my own assignment was that of assistant navigator, under a man who had proven to be a good friend on the previous cruise.

The Utah is comparatively a new ship, having been commissioned in the autumn of 1911. Her overall dimensions, except for her draft of 29½ feet, are, roughly speaking, approximately those of the City of Detroit III., 523 feet extreme length, 88½ feet beam. Her four screws are driven by four Parsons turbines, fed by twelve Babcock and Wilcox watertube boilers, developing theoretically 28,000 horse power, but actually being capable of being pushed very much beyond this figure. Her trial speed was a little better than 21 knots, while her ordinary displacement is 21,800 tons, about that of the Wm. P. Snyder Jr., under full load. Her main battery consists of ten 12 in. guns mounted on five armored turrets, two being placed forward of the bridge and three aft, while her torpedo defense battery consists of sixteen 5 in. guns, and, in addition, she carries two torpedo tubes. Her complement is about 1,000 officers and men, who are adepts at practically all the trades found in a small city. A small machine shop with a limited number of good machines and tools, a brass foundry, printing office, large distilling and refrigerating plants, a mechanical store room containing over 1,500 articles, a bakery capable of producing 600 loaves of bread per day, a good sized butcher shop, barber shop, large stores of clothing and shoes of all kinds, together with men to repair them and keep them in order, are a part of her equipment. All in all, she is a fine big ship, but I could not help but feel that her mere size was less impressive to a man used to the big side-wheeled passenger steamers and 600-ft. freighters of the lakes than to the men who are used to the much smaller tramp steamers of the coast.

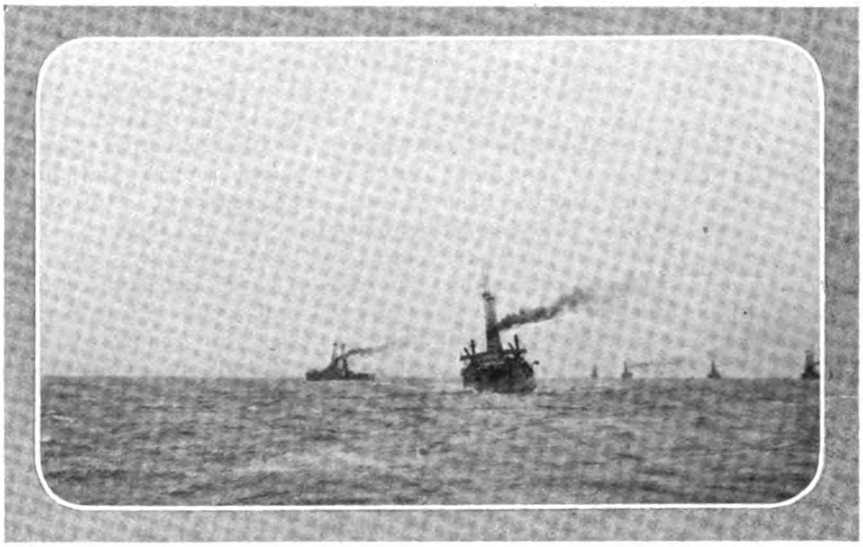
Saturday afternoon, Oct. 25, the nine ships composing the fleet and the train, consisting of the hospital ship Solace and three colliers, got under way at 1:30 and steamed out of Hampton Roads, saluting the assistant secretary of the navy, Mr. F. B. Roosevelt, who bade us good-bye with the following words: "In sending you off today as representatives of the United States navy, we hope to show the Old World that the achievements and traditions of the past are being sustained and carried forward to a still more splendid future. Good luck and God speed."

At 4:50 Cape Henry was abeam and the fleet was headed on the great circle course to Gibralter, north 70 deg. east, speed 12½ knots or 14.3 miles. Darkness soon shut out the sight of land, and save for a couple of ships, we saw nothing outside of our own fleet until we picked up Cape St. Vincent on the west coast of Spain, a week from the following Wednesday. Midnight that night took us through the straits of Gibralter, about 11½ miles wide, and the fleet immediately broke up into five units; the Wyoming going to Malta, the Arkansas and Florida to Naples, the Utah and Delaware to Villefranche, the Kansas and Connecticut to Genoa and the Vermont and Ohio to Marseilles. At 8.15 on Saturday, Nov. 8, our unit entered the picturesque harbor of Villefranche, saluted the French flag with 21 guns and tied up to our mooring—our engines slowing down for the first time since they were started at Hampton Roads—after an exceedingly busy and interesting but comparatively uneventful cruise of 4,700 miles.

The avowed purpose of the cruise was to give the men an opportunity to visit Europe; in other words, to keep the promise made by the depart-

UTAH DIVING INTO THE SEAS. ARKANSAS IN THE DISTANCE

ment in advertising for recruits that "the navy gives young men a chance to see the world." Every arrangement had this object in view. The ships stayed in one port during the entire time that the men might not be required to return aboard to move them. Each ship's company was divided into three parts, which, in turn, were given seven days' leave, which the men might employ as they liked, either remaining in the immediate vicinity and returning aboard the ship each night, leaving it again in the morning or absenting themselves during the entire time. The serious purpose of seeing Europe was gone into with the thoroughness which characterizes everything that is done in the fleet. The ships were full of guide books and moving pictures of places to be visited were shown almost nightly on the trip over. Officers were formally detailed to arrange trips for the men, look up accommodations and secure the best possible rates. Instructions and suggestions were given by those who had been in Europe before. Circulars were printed by the ships giving the relative value of the coinage of the different countries, and the men were paid off in French or Italian gold. Military rates were obtained from the French and Italian railroads, so that in the latter country any sailor could travel for 25 per cent of the regular fare. And the men appreciated and took advantage of the opportunity. Many of them were entirely new, a large draft having just been sent forward from the Great Lakes Training station, and for them the chance was an unusually good one. No matter where one went in central or southern Europe he found the American blue jacket. I saw him in the galleries of Paris, the mountains of Switzerland and the ruins of ancient Rome, studying, observing, absorbing the best that Europe had to offer to wide-awake America, and wherever he went, I found him courteous, sober and self-respecting. Much has been written of the good behaviour of our men while ashore, and none of it has been exaggerated. If there was to be any rowdy conduct, one would expect to find it in the ports in which the ships were anchored, because here would be found the men who wished to spend their money in having a "so-called good time" rather than in travel, and yet Gen. Carbillet, commanding the land forces of Southern France, said as he was bidding good-bye to the officers: "I am simply delighted at the behavior of your enlisted men. I entered one of the largest cafes in Nice two nights ago

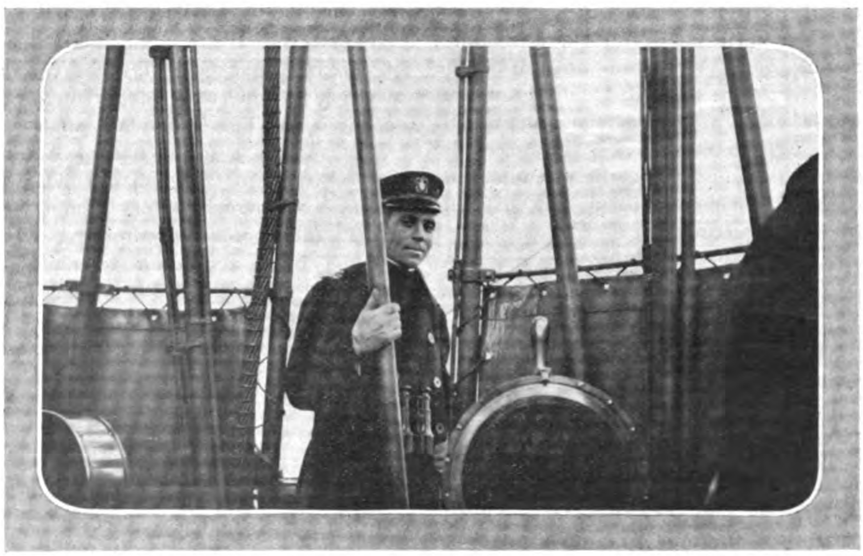


STEAMING IN LINE OF BEARINGS IN A ROLLING SEA

and eighty American seamen were at tables which they had engaged. The band played the 'Star Spangled Banner.' Everyone rose, and at the close they threw their hats in the air, and as one man shouted 'Viva la France,' and then re-seated themselves. I was never so touched by anything in my life. Today I heard of a similar incident in a tram. Seven American blue jackets occupied adjoining seats when three women entered. All rose like men at drill, while the natives remained seated."

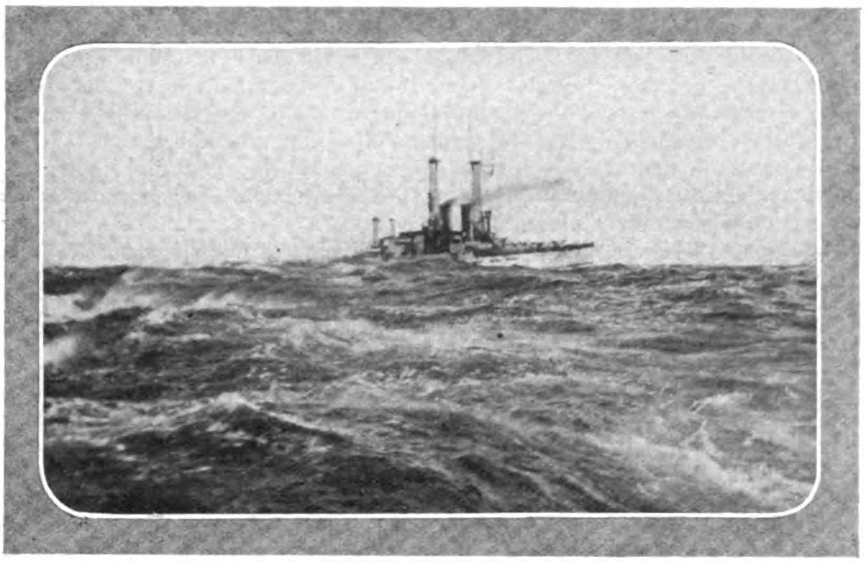
The men enjoyed the trip and it did them good. There was less grumbling and fault-finding on the way back than on the way over, for they had come in contact with other countries, other modes of living and other sailors, and they were better citizens for the knowledge they had gained. When one considers that the only cost of the trip was the coal burned, for ships must be kept up and men must be paid whether at home or abroad, there can be no question but that the cruise paid for itself many times over!

This was the first time that any of the dreadnaughts, except the Delaware, had crossed the Atlantic and the first experience at sea in them, for many of the officers who had recently been detached from other duties, and there was a good deal of speculation as to the probable behavior of these big ships in rough weather, some freely expressing the opinion that ships so large and massive could ride most any sea with little motion. On the way over we had two days of a dead roll, with practically no wind, which gave us about sixteen degrees of motion on either side of the perpendicular. On the way back, two days of head wind demonstrated without question that these great ships can pitch and



THE STEERING PLATFORM IN THE BASE OF THE FIRE CONTROL MAST. LIEUT. E. J. FAY, U. S. A.

that they can be exceedingly wet and uncomfortable. As one stood on the bridge as it rose upon the crest of a wave and then started to coast down it until it seemed as though the bow were heading straight for the bottom, one felt much as though he were riding on a roller coaster. Each plunge scooped up tons and tons of water, which rushed back over the deck only to be thrown off, as the stern settled in the trough behind, like water falling from a small Niagara. Time after time I saw the bow of the Florida, which was next in line to us, disappear under the top of the sea only to rise so high on the next wave that I could see the entire keel for 30 to 40 feet back from the ram. The heavy spray was driving across the navigation bridge until it baffled even the heaviest rubber clothing, while the force of the wave was driving the water into the tightly battoned gun ports and hatches until ward room and sleeping rooms were wet and uncomfortable and we were forced to dodge flying water even as we sat at our meals. Although in some ways disagreeable, this experience with the dreadnaught division during a storm was exceedingly interesting.



A DUSTY DAY ON THE ATLANTIC—THE FLORIDA AND THE DELAWARE

Colliers for Panama Canal

Contract for building two colliers, equipped ready for service, has been let by The Panama Canal to the Maryland Steel Co., of Sparrow's Point, Md., at the price of $987,500 each. These are the vessels provided for in an act of Congress, appropriating for sundry civil expenses, approved June 23, 1913, in which the building of two colliers to convey coal to the canal coaling plants was authorized at a cost of not more than $1,000,000 each.

The navy department was authorized to prepare the plans and specifications and to advertise for bids from both government and private yards. The vessels are to be approximately 500 ft. long, 62 ft. in beam, and 39 ft. 6 in. deep. They are to have a cargo capacity of 12,000 tons of coal, with reservations of space sufficient for bunker coal for a trip from Norfolk to Colon and return, and other requisite materials and supplies for operation. Their sea speed, loaded, is to be 14 knots, and their maximum draft is not to exceed 28 ft., in sea water.

The bids, opened on Feb. 2, 1914, ranged from $970,000 to $1,436,000 for each vessel. The lowest bid was made by the Maryland Steel Co., and a supplementary bid, providing for certain improvements in construction and material at an additional charge of $17,500 per vessel, was recommended by the navy department and accepted by The Panama Canal.

The ships are to be named Achilles and Ulysses, in conformance with the practice of giving colliers names from Greek and Roman mythology. They will be built according to navy department practice and when completed will be very similar to the Orion and the Jason, which, after extensive service, are regarded as very satisfactory. It is expected that they will be placed in commission early in 1916.

Wm. G. Abbott, Melford, Del., launched on May 16, a fishing steamer for the Coast Fish Oil Fertilizer Co., of Lewis, Del.

Vessels for Erie Barge Canal

The New York & Buffalo Steamship Co. has been incorporated under the laws of New York state with a capital of $3,500,000 to operate a fleet of vessels upon the Hudson river and the New York state barge canal now under construction. It is proposed that 30 vessels each of 1,500 tons capacity each will be constructed for the new line. The boats will be of unusual type in that they will be driven by electricity and will be controlled from the pilot house. They will be 276 ft. overall, 40 ft. beam and 6 ft. draught deep loaded. Tenders now are being asked from different ship yards for the construction of the fleet. Ten of the vessels are to be ready by fall, ten next spring and the final ten in the spring of 1916 when it is expected the complete barge canal will be ready for navigation. The boats will carry both passengers and freight. Charles W. Morse, the eastern steamship man, has organized the new company and Capt. M. L. Gilbert, now president of the Southern Steamship Co., will be the general manager.

Building Two River Barges

The Racine - Truscott - Shell Lake Boat Co., Muskegon, Mich., has just closed contract for the construction of two 150 ft. river barges.

These barges will be operated upon the Savannah river between the cities of Augusta and Savannah. They will have a carrying capacity of 300 tons of freight each on a draft of 4 ft.. They are to be operated by twin screws working in tunnels. The machinery of each barge consists of a pair of Wolverine 3-cylinder engines of 75-H. P. each, operating on producer gas, which will be furnished by Galusha producer.

The boats are intended for freight only, and each barge is fitted with freight house 104 ft. in length, and 15 ft. high. Above this forward is a pilot house, the officer's and crew's quarters. The boats are being built on order for the Augusta Savannah Navigation Co., of Augusta, Ga. They will be completely erected at Muskegon, then knocked down and shipped by rail to Savannah where the final assembly will take place.

The Keyes Products Co., 71 W. Twenty-third street, New York, is furnishing bulkhead and deck panels of non-inflammable Nevasplit for a river steamer building by James Rees & Sons, Pittsburgh, Pa.

Two Bucket Dredgers

The Collinwood Ship Building Co. Constructs the Largest That Have Ever Been Built in Canada for the Dominion Government

THE Collingwood Shipbuilding Co., Collingwood, Ont., has completed two powerful bucket dredgers with central well for the Canadian government's department of marine and fisheries. These vessels are the largest of this type ever built in Canada and are intended to operate in the St. Lawrence Ship Channel. The principal dimensions are as follows:

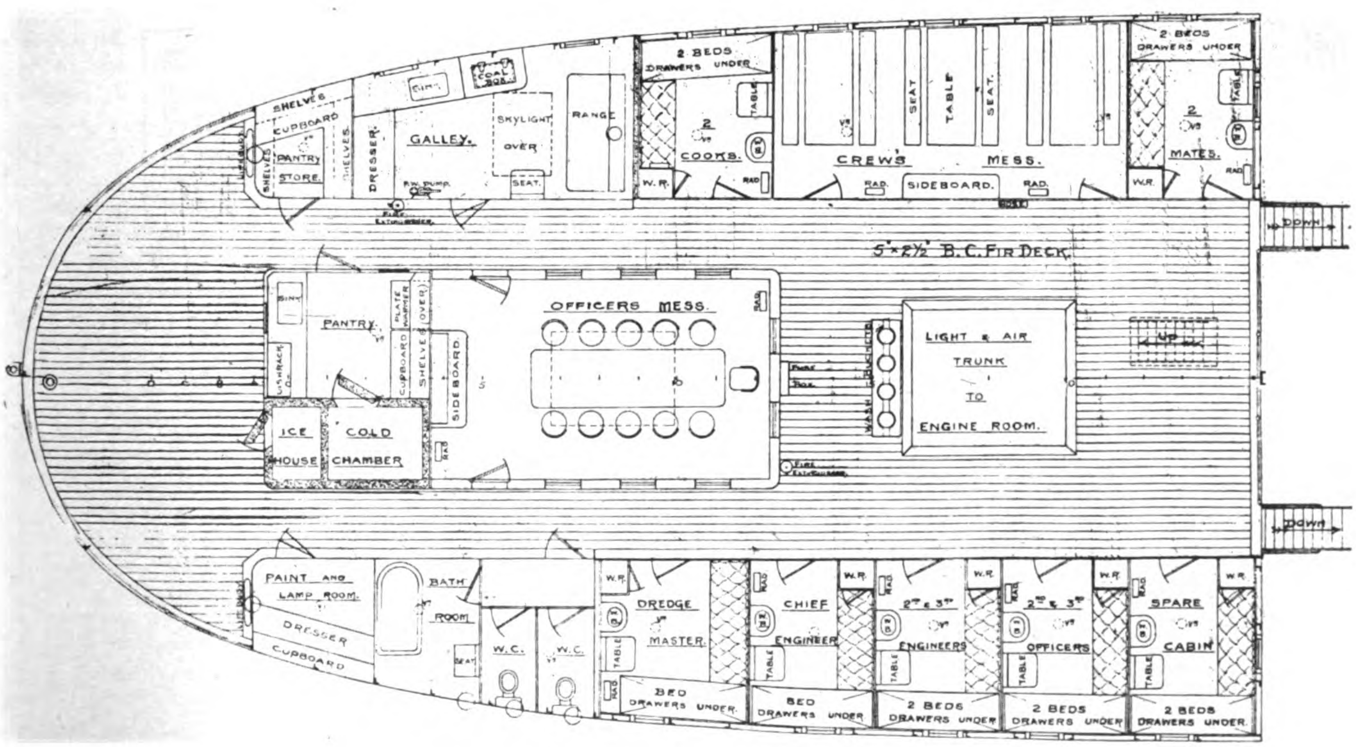
	ft.	in.
Length, B. P.	215	0
Breadth, moulded	37	6
Depth, moulded	14	0

They are built under Lloyd's special survey to take 100-A.1 dredger class and under government inspection. The dredging gear and propelling machinery are of exceptionally heavy design in order to cope with the hard pan and rock which is encountered in many parts of the St. Lawrence river. The ladder is of very substantial construction, 117 ft. long and arranged to accommodate a chain of forty buckets, each of 27 cubic ft. capacity. The buckets have cast steel backs, heavy boiler plate bodies and manganese steel lips, and each one is provided with four heavy cutting teeth with tool steel points. The bucket links are forged and the pins and bushings are manganese steel. The tumblers are of cast steel, the bottom one being six-sided and the top one five-sided. To stand the wear and tear, the bottom tumbler shaft is fitted with a hard steel liner and a manganese steel bush in halves. When the ladder is at an angle of 45 deg. the dredge can dig to a depth of 52 ft. below the water level.

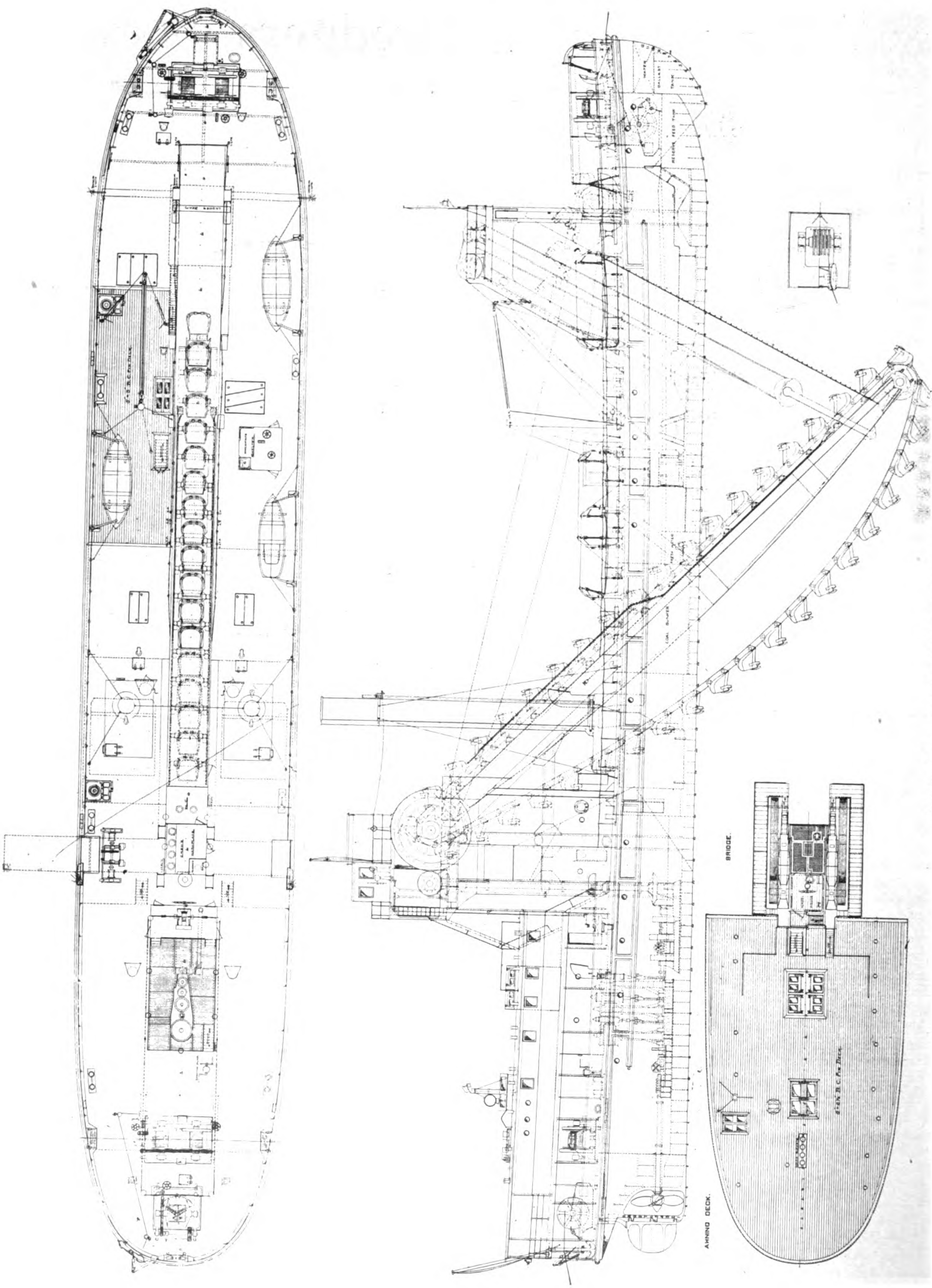
The propelling machinery consists of one set of triple expansion, surface condensing engines of the Collingwood Shipbuilding Co.'s make, with cylinders 15 in., 25 in. and 42 in. by 26 in. stroke. A clutch is arranged between the crank shaft and propeller in order to disconnect when the vessel is digging. Forward of the engine a heavy change speed gear arrangement is fitted, having a double clutch so as to give two speeds on the chain of buckets, the low speed being 10 to 12 buckets and the high speed 18 to 20 buckets per minute, the latter speed being intended when dredging in soft material. The vertical shaft driving the top gears and surge wheel is 11 in. diameter, and all the gears and pinions are of cast steel. The surge wheels are each 15 ft. 6 in. diameter, the outer rim having double hellical teeth. The friction is arranged by means of brass faced cod pieces and tightening screws.

The boilers are of the usual marine type, two in number, 11 ft. 6 in. diameter by 10 ft. 6 in. long, fitted with Howden's forced draft, and arranged to work at a pressure of 180 lbs. per square inch.

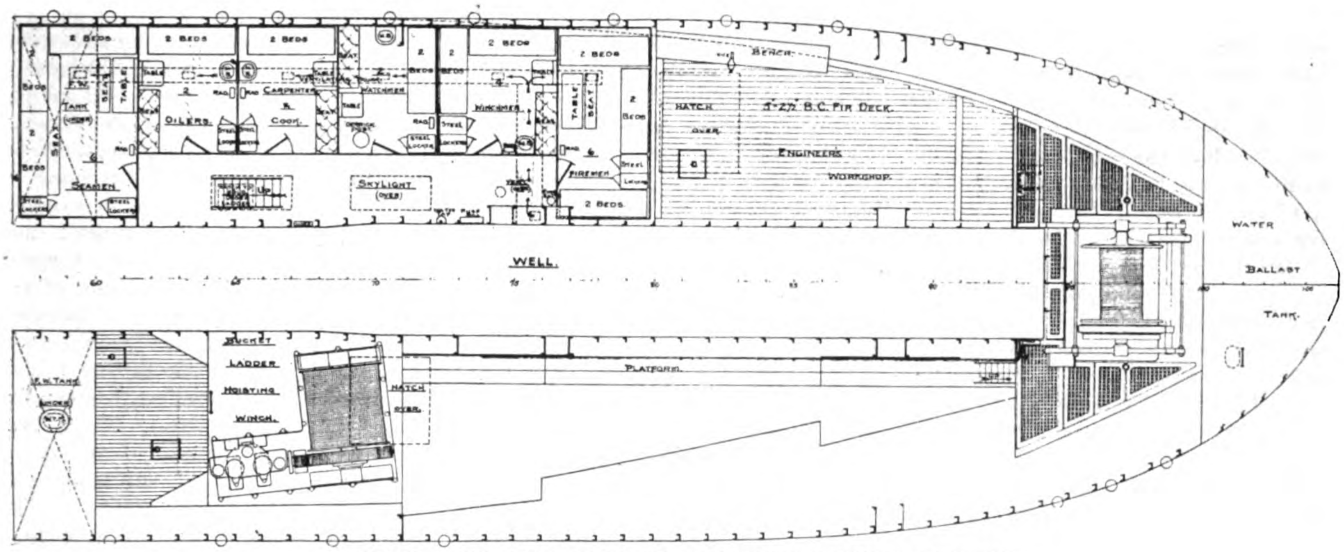
A very complete installation of engine room auxiliaries has been fitted, and comprises a 10 in. by 20 in. by 10 in. vertical monotype air pump, one pair of direct-connected feed pumps 7 in. by 5 in. by 15 in., one vertical duplex general service pump 7½ in. by 4¾ in. by 10 in., one 6 in. centrifugal circulating pump, two vertical simplex bilge pumps 6 in. by 5 in. by 10 in., two vertical duplex sanitary and feed water pumps 4½ in. by 4 in. by 5 in., one G. & J. Weir's surface feed heater, one See's ash ejector in each boiler room. A complete electric installation is fitted, two 11 kilowat machines being installed, either one of these being capable of handling all the lights aboard the vessel. A 24 in. diameter searchlight of 25,000 c. p. is fitted on the shade deck aft for use in reading draft gauges on the river at night. A 60 in. Howden's fan is fitted for supply-



PROMENADE DECK OF CANADIAN BUCKET DREDGER



MAIN DECK OF CANADIAN BUCKET DREDGER
AWNING DECK, BRIDGE AND INBOARD PROFILE OF CANADIAN BUCKET DREDGER



LOWER DECK AND HOLD OF CANADIAN BUCKET DREDGER

ing the necessary forced draft to the boilers.

The engine room is very large and is supplied with abundance of air, light and ventilation, which is a special requirement for the heat experienced in the St. Lawrence river during the summer months.

The deck auxiliaries consist of one 9 in. by 18 in. bow winch situated on a flat under the main deck with special lead for chains through a hatch on the upper deck, the drum of the winch is designed to accommodate 4,000 ft. of 1½ in. steel wire rope and 300 ft. of 1½ in. chain. One 9 in. by 16 in. stern winch, and two 9 in. by 16 in. breasting winches. The breasting winches have drums arranged to handle the port and starboard wires and each winch is capable of accommodating 4,000 ft. of 1¼ in. wire rope and 300 ft. of 1¼ in. chain cable. Six anchors are fitted for working the vessel, one bow, one stern and four breasting, and these are of the ordinary type with stocks and are of suitable weights for securely mooring the dredge when working.

A very powerful engine and drum has been installed in the lower hold on the starboard side for handling the very heavy bucket ladder and its equipment. The engine is of the vertical type, with two cylinders 14½ in. diameter by 13 in. stroke, and like the deck auxiliaries, operates with steam at 90 lbs.

The hoisting rope is of special plough steel 1¾ in. diameter, and the drum on the hoisting engine has been made large enough to accommodate all the rope without riding. In addition to the main hoisting rope steel wire preventers 2¼ in. diameter are fitted to each side of the bucket ladder for use should anything go wrong with the side rods.

The hoisting sheaves are cast steel 4 ft. 6 in. diameter, specially arranged to take the above cable, the bottom and top blocks having five sheaves each, while a special idler sheave is fitted on the top of the bow shear legs. These shear legs and the main framing have all been specially designed to take care of the heavy strains which come on them owing to the massive design of the bucket ladder and the other dredging gear.

A winch 6 in. by 8 in. has been installed on the port side to handle the side chute. One side chute only has been fitted in the meantime, but arrangements have been made so that in the event of the vessel having to discharge on the starboard side, a chute could readily be installed. For handling barges two 8 in. by 8 in. capstans have been installed on the main

POWERFUL BUCKET DREDGER BUILT FOR THE DOMINION GOVERNMENT BY THE COLLINGWOOD SHIP BUILDING CO., COLLINGWOOD, ONT.

deck on the port side.

The steering gear consists of a 5½ in. by 5½ in. steam engine situated on the upper deck inside the engine casing, the customary lead of chains, spring buffers, quadrant, etc., have been fitted. The gear is also arranged to operate by hand.

A steel derrick post with steel derrick is fitted on the port side of the main deck and arranged in such a way that it can readily handle the buckets when these have to be changed. It is also arranged to serve the hatch over a workshop which has been fitted on the lower deck forward.

The accommodation for the dredging master and officers is fitted on the promenade deck aft, and have been designed to give as much light and air as possible. The crew are accommodated with large rooms on the lower deck forward. These vessels usually work day and night throughout the season of navigation, and therefore accommodation for a double crew has been provided. Suitable galley, pantry, storeroom and lavatory accommodation has been installed.

The forepeak has been arranged for water ballast, and a reserve feed tank has been fitted immediately aft of this for use if ever the vessel goes to salt water. Fresh water tanks are incorporated with the ship's structure just forward of the coal bunkers.

Complete arrangements for pumping and draining, heating and ventilating, have been installed, and a complete equipment of telegraphs, nautical instruments, river and dredging lights, etc., has been supplied, together with a full supply of spare parts for all the machinery and dredging gear.

Both ships were practically completed last autumn, but could not be got away before the close of navigation owing to the poor delivery of important materials, and had, therefore, to be held until the opening of navigation this year. The first vessel successfully carried out digging and speed trials on April 23 and 24 under the supervision of Mr. McNab, of the department of Marine and Fisheries; Mr. Forneret, the chief engineer of the St. Lawrence ship channel, and Mr. Steadworthy, dredge master; the h. p. p. developed being 950 at 120 revolutions per min. and steam at 180 lbs. per square inch, which is well over the specified requirements. The second vessel's trials were equally successful, and were completed May 6. Both vessels will leave Collingwood for Sorel, P. Q., a distance of over 1,000 miles on May 9th.

Superheated Steam

*The Use of Superheaters and Superheated Steam in Mercantile Steamers**

By Harry Gray

THE reintroduction of superheaters in boilers, and the use of superheated steam in engines of the mercantile marine, has been brought about by continuous research together with costly experiments by the greater knowledge obtained in the process of making and amalgamating metals, by the improvements in the manufacture of such metals into tubes and other suitable forms, by the introduction of oxy-acetylene and electric welding, by the preparation of lubricating oils for use under high temperatures, together with a mass of data, the result of years of experimenting and investigation, and which has now been put to the crucial test of practical working.

Superheaters, when introduced into marine boilers some 70 years ago, developed rapid deterioration, producing such a heavy bill for repairs and renewals that they were regarded as too costly, not to say dangerous, for use on board a steamer, and it is possible that the experiences and the troubles which then developed have contributed to the extreme caution exhibited by many engineers and steamship owners in considering the pros and cons of the use of superheaters and superheated steam today.

*Paper read before the Institute of Naval Architects, April 2, 1914.

In the *Mechanics' Magazine* of April, 1861, appears an article on "Superheated Steam", which is a most interesting record of what may be considered the last serious effort to give a superheat to steam for use in steamers, and the following extracts are taken therefrom:

"Thomas Howard is credited with establishing the fact that great economy might be effected by the principles of superheating in about the year 1833, and that Dr. Haycroft shortly afterwards urged its application on the ground that it would effect a saving of 30 per cent in fuel. The Prince Alfred, of 200 horsepower, belonging to the Inter-Colonial Royal Mail Co., is stated as being 'the first sea-going vessel working with unmixed superheated steam, and fitted with Partridge's system'. Other vessels mentioned are the Damasmus, of 200 h. p., the consumption per indicated horsepower being reduced to 3 lbs. In the Tyne a vessel of 400 h. p. was fitted, and 'it was found very beneficial during a voyage from Southampton to Rio de Janeiro and back'. The H. M. S. Dee was fitted, and after four years was reported as in good condition. Altogether 50 vessels were fitted with 'Partridge's' apparatus, representing 10,000 to 12,000 h. p., and the savings effected by the use varied from 15 to 30 per cent. In general, the steam was superheated to about 340 deg., and the pressure ranged from 10 lbs. to 25 lbs. per sq. in. Other superheating apparatus mentioned are those of Parsons and Pilgrims, fitted on the Osprey in 1859, also H. M. S. tug Bustler in 1859, and in 15 other vessels. Lamb's superheater, patented in 1858, was adapted to over 50 vessels with a saving of 20 to 40 per cent. Boden and Clarke's superheaters were fitted on the Southampton in 1860, trading between Southampton and Channel Islands, of 262 h. p. condensing engines with two-slide oscilating 60-in. cylinders, 5-ft. stroke. She burnt only 37 tons on each trip out and in, averaging 22 hours, or about 12 lbs. per horsepower. The Despatch was also fitted. Butler's superheater was fitted to the City of Nantes, with a saving of 30 per cent and increased speed. Pullen, Cresswell and Longstaff's apparatus, patented in 1860, and many others which showed equally favorable results. Reference is also made to the researches of Dr. Taylor, Mr. Brande, Professor Faraday, Mr. Fairbain and others."

J. and W. Dudgeon, of Millwall, between 1859 and 1870, fitted about 40 vessels with Beardmore's system of superheat.

The steam engine being essentially a heat engine, no excuse is needed for

advocating the use of superheat; if such were the case, however, the records of the past 70 years alone are full of instances of the devices brought out for steam-jacketing, reheating and other arrangements for retaining and maintaining the temperature in the cylinders. The drop in the temperature, not only between the boilers and the engines but also in the cylinders themselves, beyond that due to the expansion of steam, has been, if not the greatest, at least one important cause of loss of power in steam engines, as it has thereby increased the amount of saturation in the steam. Another loss arose from the amount of saturation brought over by the steam from the boilers, when priming was not violently taking place. This loss is seen more or less in all marine engines by the quantity of water which comes down through the piston-rod glands, to the detriment of the packing and the piston-rods. It is also manifest by the noise which betrays the presence of water in the cylinders, although there may be none of the usual evidence of priming in the boilers, which shows that whilst a small percentage might be attributed to condensation in the cylinders, a large volume is really due to the heavy state of saturation of the steam coming from the boilers, and, moreover, that this is a variable quantity, due, no doubt, to the conditions of firing, circulation, or the quality of fuel.

Water From Cylinders

In order to obtain some data bearing upon this loss, measurements were taken of the water coming from the cylinders of quadruple expansion engines of 3,000 indicated horsepower working under saturated steam conditions, readings being taken during the voyage, and at times it was found that as much as 20 gallons per hour was drained off the M. P. 2 and L. P. steam chests. The fact that such a quantity of water was found to accumulate in the cylinders of a quadruple-expansion engine, working under saturated-steam conditions, convinced Alex. J. Dudgeon and the writer that superheat would convert this loss into effective horsepower and so contribute to a more economical result. The modern system of superheating steam passes the saturated steam from the boiler through small tubes placed in different positions, according to the type of boiler, whether water-tube or marine cylindrical multitubular, usually termed the "Scotch" boiler. Some of these systems have been placed before the members of the institution in papers read by Professor W. H. Watkinson, on "Some New Types of Superheaters", in 1903; by Felix F. T. Godard, in "Notes on the Use of Superheated Steam with Marine Engines", in 1908; by Mr. Yarrow, on "Results of Experimenting with Water-Tube Boilers with Special Reference to Superheating", in 1910; and also before the Institute of Marine Engineers by Mr. White, on "Marine Engines under Superheated Steam", in 1910.

Design of Superheaters

It is not proposed to deal with the various points of interest regarding the different types or design of super-heaters which naturally arise, but which do not come within the scope of this paper, which is confined to the experience of the use of superheat on steamers, with special reference to the important question of economy and cost of upkeep, based on over three years' working in engines of both triple and quadruple expansion type in the mercantile marine engaged in a regular trade, voyage after voyage, to Australia via the Cape of Good Hope. In the system adopted (Schmidt's) the steam from the boilers passes into a vertical pipe called the "saturated" header placed in the smoke-box, from which small branch pipes are led horizontally across the front of the tube plates, the pipes passing down each tube of the row being doubled in a *U* form for that purpose,, so that each "element", as it is termed, is a series of *U*'s, the other end being brought back to what is termed the "superheated" header. The jointing of each end of the element to the headers is effected by a small cross bar or "dog" with a stud through the center, so that each dog makes two joints. Careful supervision, testing and tightening up, as the pressure rises when getting up steam, prevents any leakages afterwards, as when once tight the fittings do not give trouble. A drain is fitted to both headers, that on the saturated header for blowing away any scum that might be brought over from the boiler, and which would possibly choke the lower rows of elements, and a drain on the superheated header to permit of a circulation of steam through the elements when getting up steam, or when the steam is not being circulated in consequence of the supply to the engines being shut off whilst working the engines to orders in ports. The elements are examined periodically, being removed from each nest of tubes in rotation, so many each voyage; thus all are dealt with at least once a year; but whenever the boilers are cleaned the ends of the elements are examined from the combustion-chamber, as they are only about 9 in. inside from the back tube-plates, for any signs of leakage at the weld of the *U* bend of the elements. These defects are something less than 0.1 per cent, and are generally only pin-holes. Even should it be necessary to deal with the *U* end it is not a serious matter, either in time or expense, and, in the event of a serious leak, the steam from the boiler can be shut off the superheater and by-passed direct to the engines, whilst the defective element is withdrawn and the joints on the headers remade with blank plugs, the gross area through the elements allowing for a considerable reduction without unduly wire-drawing the superheated steam. Experience has shown no deterioration of the elements from corrosion or burning of the end, or any injurious action on the boiler tubes. The chief expense incurred with superheat is on account of extra labor when withdrawing these elements for inspection. None of the steamers under consideration has been delayed either in port or on the voyage from defects in superheater elements since being fitted, notwithstanding the fact that they are turned round quickly and have long runs, that of the Port Augusta being 45 days without a call at any port, and the Port Lincoln and Port Macquarie 39 days, with a call of a few hours only at Cape Town for coal and fresh water. The cleaning of the tubes on the voyage is effected by "Diamond Blowers" fitted in each combustion chamber, and they are blown through every day, the operation taking about two or three minutes for each nest, the soot which accumulates in the smoke-box being cleared away through the doors provided for the purpose. These blowers can be fitted to double-ended as well as single-ended boilers.

Internal Lubrication

The absence of moisture, upon which marine engines rely for internal lubrication, makes the lubrication of the cylinders and valve faces of most vital importance when superheated steam is used. In the first instance, an excess of internal lubrication is advisable, until the pores of the metal surfaces become saturated and filled up with oil. When this has taken place it will be found that, although the surface of the cylinder walls may be cleaned and wiped when they are hot, upon the metal cooling down a film of oil will be squeezed out of the pores on to the surface of the metal. When this condition has been attained, the quantity of oil for internal lubrication may be reduced with safety.

On the Port Augusta, of 2,000 indi-

cated horsepower, 1.5 gallons per day of cylinder oil were used at first for internal lubricating and swabbing of piston-rods of both main and auxiliary engines; on the Port Lincoln and Port Macquarie, of 4,000 indicated horsepower, about 2 gallons per day, this being gradually reduced until now only 0.5 to 0.75 gallon is required. Another important detail with regard to this is that independent means of lubrication must be provided for each engine, either in the valve-chest or cylinder. That for the high-pressure cylinder should be on the engine side of the stop and throttle-valve, otherwise the surfaces are liable to become coated with an oil deposit during a long run, and may cause them to work stiff, thereby interfering with their steam tightness when brought into use again on working the engines to orders. It is advisable to arrange for independent lubrication for the low-pressure valve, as owing to its being generally of the flat "D" type and unbalanced, the large surface even with a low pressure upon it, gives rise to considerable friction. It has been found in triple expansion engines, where the medium-pressure cylinder is placed adjoining the high-pressure cylinder with short exhaust passages, that, after the surfaces become saturated with oil, the regular supply to the medium-pressure cylinder may be shut off, as it would appear that a sufficient quantity of the oil injected into the steam in the high-pressure valve chest becomes vaporized and is carried over to the medium-pressure valve chest with the exhaust. Nevertheless, in the first instance, a regular supply should be injected into the medium-pressure valve chest, and even when this is shut off, a little extra oil should be injected from time to time, according to the evidence of the running and condition of the surface when opened up for examination.

Problem of Lubrication

The selection of a suitable lubricant for internal lubrication under the temperatures and conditions met with when using superheated steam is one requiring consideration. There are several oils on the market with a flash-point under the open test of from 610 deg. to 630 deg. Fahr., but due consideration must be given to their composition, whether it represents an absolute mineral oil, or a compound of a mineral with an animal or vegetable oil, which, it is claimed, adds to the lubricating qualities without creating troubles from carbonization or other causes; this, however, is a doubtful point. Upon the question of the evaporation-point, and also the flash-point, when the oil is under pressure, we know of no reliable data; possibly these points are higher under pressure than those obtained by the tests under atmospheric conditions. It is absolutely necessary to have a reliable system of filtration for the feed-water, so as to ensure the abstraction of the oil and to safeguard the boilers from the possibility of any traces getting through. The difficulties at first met with to obtain this result have been overcome by fitting a large gravitation filter.

Filtration

The whole secret of filtration is "time" to allow the feed-water to come almost to rest, and enable the oil to rise to the surface and be collected; afterwards the feed-water should pass through a chamber filled with coke, and finally through a section fitted with "cartridge" cylinders, covered with filter-cloth toweling of substantial body having a rough surface. The more compartments of the first or settling stage that are provided, the longer the coke and filter-cloth sections will last without requiring to be changed. The filter must be so placed that the water will gravitate to the same water-level as the weir in the hot-well of the air pumps. It is essential that the covers of this filter should be always open when working, so that it may be under observation, and that the thick scum accumulating on the surface of the settling chambers may be removed by hand from time to time.

The cleaning of the coke and filter-cloth chambers can be done very quickly if a full set of spare parts is carried, which can be kept charged with fresh coke and with clean filter-cloths on, ready for use. When such spare parts are provided there is no necessity for a by-pass arrangement, as the working of the filter is not interfered with during the process of changing the filtering medium, and the time is so short that no danger from oil passing through with the feed-water is experienced.

The feed-water betrays not the slightest sign of oil, even in emulsion, when drawn off from the feed-pumps; there is no "taste" of oil perceptible; the internal surfaces of the boilers, even on the water-line, do not show any signs of oil, and this has been confirmed in each of the four boilers in both the steamers with quadruple expansion engines having passenger certificates, upon inspection at the end of six and twelve months' service, as well as at the annual survey on the other steamer, fitted with triple expansion engines and two boilers. The temperature of the steam during the various stages is ascertained by pyrometers fitted to the superheater steam pipe of each boiler to the H. P. and M. P. 1 steam chests, and by thermometers fitted in the steam chests of the M. P. 2 and L. P. engines. The general experience with the pyrometers having long connecting capillary tubes filled with ether or mercury, by means of which the temperature is recorded on the dial, shows a tendency to give unduly low readings after months of constant use, to the extent of about 5 per cent, necessitating their being frequently tested, and short connections are therefore recommended, although the position of the dials may not then be so conveniently arranged for observation. The variations in the reading of the pyrometers, due to the fluctuations of the temperature of the steam following on the condition of the fires, indicate beforehand the rise or fall of the steam pressure, and enable the engineer on watch to know in which boiler the furnace temperatures are falling, through the fires getting low or dirty, and so give the necessary orders to maintain a full steam pressure. The fitting of pyrometers and thermometers in this manner has given some very interesting information as to how far the superheat is carried through the engine, in other words, whether the temperature of the steam due to superheat falls more or less quickly than the temperature of the steam consequent upon the pressure, so as to in-

	S. S. Port Augusta. Triple Expansion Engines.				S. S. Port Lincoln and Port Macquarie. Quadruple Expansion Engines.			
Steam Chest.	Gage pressure in steam chests, lb.	Temperature due to steam pressure, deg. Fahr.	Temperature recorded, deg. Fahr.	Degree of superheat, deg. Fahr.	Gage pressure in steam chests, lb.	Temperature due to steam pressure, deg. Fahr.	Temperature recorded, deg. Fahr.	Degree of superheat, deg. Fahr.
High pressure	160	370	550	180	206	389	600	+211
First intermediate ..	53	300	400	100	97	335	460	+125
Second intermediate.	..	...	...	...	38	284	290	+ 6
Low pressure	10	240	?	?	9	237	220	— 17

dicate at what stage, if any, the steam loses all "superheat" and returns to the "saturated" state.

The table on page 216, which is approximately reliable, gives the average results obtained, although the higher temperature taken by the pyrometers may, as before mentioned, be lower than was actually the case.

It will be seen that superheat is shown in the steam chest of the first three engines, and almost in the low-pressure, while at times a few degrees of superheat are reported to have been actually registered there. The cut-offs are about: H. P., 73 per cent; M. P. 1, 70 per cent; M. P. 2, 70 per cent; L. P., 70 per cent.

The steamers from which these data were obtained belong to W. Milburn & Co., of London, and our thanks are due to Mr. Milburn for his permission to place the results before the institution. The Port Augusta was built and engined by Hawthorn, Leslie & Co., in 1906; the boilers were fitted with superheaters and the necessary alterations made to the engines, etc.,, by the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, in May, 1911, when the boilers and engines were five years old. The Port Lincoln and Port Macquarie were built by Hawthorn, Leslie & Co. and engined by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, in 1912. The boilers were designed for working the engines under saturated steam requirements, but fitted with superheaters. The Port Albany was also built by Hawthorn, Leslie & Co., and engined by the North-Eastern Marine Engineering Co., but the boilers were designed for and fitted with superheaters.

Particulars.	Port Augusta.	Port Lincoln.	Port Macquarie.	Port Albany.
Length	380 ft. 6 in.	425 ft. 9 in.	425 ft. 9 in.	425 ft. 9 in.
Breadth	49 ft. 1 in.	54 ft.	54 ft.	54 ft.
Depth, molded	28 ft. 7 in.	31 ft. 10½ in.	31 ft. 10½ in.	31 ft. 10½ in.
Gross tonnage	4,063	7,236	7,236	7,236
Dead-weight	7,226	9,254	9,254	.....
Engines	Triple	Quadruple	Quadruple	Quadruple
Cylinders	27, 45, 74 in.	27½, 39, 56, 81½ in.	27½, 39, 56 81½ in.	27½, 39, 56, 81½ in.
Stroke	48 in.	54 in.	54 in.	54 in.
I. H. P. on voyage	2,100	4,100	4,100	4,100
Boilers, number	Two	Four	Four	Four
Boilers, type	Cylindrical, single ended	Cylindrical, single ended	Cylindrical, single ended	Cylindrical, single ended
Total heating surface	5,720	11,600	11,600	11,360
Total grate surface	137	240	240	260
Total superheat surface	2,390	4,000	4,000	4,320
Working pressure	180	220	220	220
External diam. of boiler tube, plain	2½ in.	2¾ in.	2¾ in.	3 in.
External diameter of boiler tube, stay	2½ in.	2¾ in.	2¾ in.	3 in.
Internal diameter of superheater tubes	13 mm.	13 mm.	13 mm.	15 mm.
Forced draft	Howden	Howden	Howden	Howden

In the case of the Port Augusta no alteration was made to the boilers, the grate surface or any of the saturated steam connections, the only change or addition being in the case of pipes or connections coming in contact with the superheated steam, and some modification was made to the smoke-boxes to allow of the superheater headers being fitted. The alterations to the engines consisted, in addition to the usual general overhaul, of fitting a balanced flat valve in place of the ordinary "D" valve for the M. P. engine, fitting of suitable piston-rod metallic packing, steel-neck bushes instead of brass, and additional lagging to cylinders, etc. A gravitation filter was installed, and afterwards enlarged and improved until its efficiency was satisfactory. The Port Lincoln and Port Macquarie are duplicate vessels in every respect; they have no auxiliary boiler, so that all demands for steam are supplied by the main boilers; these are increased above the usual requirements of auxiliaries owing to the vessels being fitted up for emigrants, which necessitates additional galleys, pantries, refrigerator machine, and electric light. The Port Albany is a duplicate of the Port Lincoln, but fitted for carrying frozen cargo, and not fitted for emigrants. Before dealing with the tabulated sults of the performances of the steamers under consideration, some description of the data available, and the basis on which the deductions have been drawn, is essential for the purpose of arriving at their value, not only to engineers, but also to shipowners. Mercantile steamers are for the commercial purpose of carrying passengers and cargo at remunerative freights, and, to do so, the cost of running involves a heavy expenditure for fuel, either coal or oil; the ordinary means of ascertaining such expenditure on the fuel account is by calculating the tons of fuel used per day.

	S. S. Port Augusta. Triple expansion. With saturated steam.	S. S. Port Augusta. Triple expansion. With superheated steam.	S. S. Port Lincoln and Port Macquarie. Quadruple expansion. With superheated steam.
Average of consecutive voyages.			
Port Augusta, London to Adelaide, via the Cape	7	5	......
Port Lincoln and Port Macquarie, London to Melbourne, calling at the Cape	......	......	6
Days on voyage	46 days 10 hrs. 46 min.	49 days 12 hrs. 2 min.	41 days 1 hr. 35 min.
Days under steam	45 days 17 hrs. 38 min.	46 days 14 hrs. 1 min.	39 days 2 hrs. 43 min.
Boiler pressure in pounds per square inch	180	180	220
Speed in knots	10.67	10.46	12.7
Draught (mean) leaving London	24 ft. 9½ in.	24 ft. 5½ in.	24 ft. 10¾ in.
Displacement (mean) leaving London	10,150 tons	10,000 tons	12,266 tons
Coal used for all purposes	1,744	1,560.45	2,335.05
Less deductions for raising steam, banked fires, winches, galley fires, crew's bogies, and condensing fresh water	34	15.0	61.88
Coals used for main boilers for supplying steam on voyage for main engines and auxiliaries, also steering gear and electric light	1,710	1,545.45	2,273.17
Less deduction for Port Augusta steering gear and electric light at 1 ton per day	46	49.5	......
Less deduction for Port Lincoln and Port Macquarie, including also steam cooking process and boilers and provision refrigerator machine at 2 tons per day	......	......	81.9
Coals used for main engines and auxiliaries (circulating pump, feed pump, evaporator, and fan)	1,664	1,495.95	2,191.27
Coal per day	36.65 tons	32.1 tons	56 tons
Coal per indicated horsepower, in pounds per hour	1.6	1.4	1.29
Quality of coal as indicated by loss reported on voyage (ashes, etc.)	14 per cent	13 per cent	16.4 per cent
Indicated horsepower	2,102	2,005.4	4,027

The data for this purpose are obtained from the voyage abstracts of the engineers' log book, which latter is also available for the verification of the daily averages as set forth in the abstract sheet. These data, when covering a number of consecutive voyages, assume a value, and in general practice are accepted as a fair basis of comparison, so that, with a known consumption of tons of coal per day, the quantity in bunkers required for a definite number of steaming days can be ascertained. The amount of coal required for loading and discharging cargo and other purposes is estimated separately according to the conditions and circumstances of the voyage.

The tabulated results are therefore not compiled upon data, such as are available in a laboratory, on the "test"

table, or even on a "trial trip" with a special staff of engineers to collect them over a few hours, or perhaps days, but they are the averages of months and years of every day's work, which for commercial purposes is the best guide, as representing what the shipowner has to pay for. The data available with the triple-expansion engines of the Port Augusta comprise seven consecutive voyages extending over three and a half years, using saturated steam, as well as the five following voyages, after being fitted with superheat, extending over three years, all of which are from London to Adelaide via the Cape of Good Hope, most of them being without any call at an intermediate port. The reason that the outward voyages have been taken is, not only that they cover the same run, but also because the same bunkers for the whole voyage were taken either on the Tyne or at Middlesbrough from the Auckland (Durham) or Mickley coal seams. The conditions, therefore, are exceptional, if not unique, for the purpose of comparison. The data dealt with of the quadruple-expansion engines of the steamers Port Lincoln and Port Macquarie are on exactly the same basis as that of the Port Augusta, and cover three voyages of each steamer to Melbourne from London, calling at the Cape, with this difference, that two-thirds of the bunkers for the voyage were Mickley coal (unscreened) and one-third Natal coal, which latter gives a higher percentage of loss (ashes, etc.), and consequent consumption, than the North Country coal. There is also a deduction of two tons instead of one ton a day on account of these steamers carrying more than 600 emigrants, besides a crew of 125, or about 740 souls all told, entailing a heavy expenditure of coal for galley fires, bakers' ovens, and steam for the cooking-presses, boilers, pantry sinks, plate heaters, etc.

The above results cover all the contingencies which arise on a long sea voyage—weather, adverse trade-winds, currents, also coal troubles arising from its being only "fair," or what is described as "dirty" or "small;" further, the human element is included, a most important factor affecting voyage results. Therefore these data have a special value to the shipowner.

The engineer naturally asks for a higher standard, by which to gage the capabilities and possibilities of the use of superheat; for this reason the results of a selected voyage, from London to Cape Town, of one of the steamers fitted with quadruple engines is given when the coal was described as "good" but "small," the weather was "fair to good," and the stokehold crowd well up to the average. Then we get:—

	Selected.	Average of 5 voyages.
Days on passage......	19 d. 10 hr.	19 d. 17 hr. 28 m.
Speed	12.92 knots	12.77 knots
Coal consumption per day for main engines and auxiliaries	50.33 tons	51 tons
Coal per I. H. P......	1.043	1.15
I. H. P...............	4.500	4,122

The part of the voyage from the Cape to Australia is generally more detrimental to exhibition results, owing to weather conditions, as well as to the less satisfactory quality of Natal bunker coal taken at the Cape, which consequently increases the daily consumption without any increase of indicated horsepower. From the results obtained we get the following consumption:

	Lbs. per I. H. P. per hr.
Triple-expansion, saturated	1.6
Triple-expansion, superheated.....	1.4
Quadruple-expansion, saturated...	1.34
Quadruple-expansion, superheated.	1.15

The figures for quadruple engines with saturated steam are taken from similar data of two steamers fitted with engines of 3,000 indicated H. P. during seven voyages each to Australia via the Cape, with the same bunkers as used for the superheated quadruple engines as far as the Cape already dealt with.

In the following comparison of the economy obtained the consumption for quadruple engines superheated is taken at 1.15 lb. per hour per indicated horsepower obtained on the voyage as far as the Cape, because coal from the same collieries—namely, Auckland or Mickley—was burnt as was used on the other steamers. In the case of the voyage averages of the Port Lincoln and Port Macquarie, the consumption works out at 1.29 lb. per hour per indicated horsepower in consequence of one-third of the coal being from Natal, giving a higher percentage of loss.

These results are shown on the diagram up to 10,000 indicated horsepower.

The additional cost of fitting superheat cannot be set down at any definite figure, as although a large number of installations have been fitted, the different conditions that have to be complied with make a comparison, in order to form a standard of price, very conflicting; still, for rough estimating, it may be taken as ranging from 15s to 20s per indicated horsepower, against which the reduced size and consequent cost of the boilers must be considered.

The full benefit of superheat can only be obtained by extending its use to all the auxiliaries, and this has been carried out on the vessels fitted when new. The steam pipes are of steel and the gland packings mostly metallic. The temperature used is about 500 degrees Fahr., and is regulated by a mixing valve from the saturated steam pipe line. This arrangement ensures dry steam to the auxiliaries without any injury, although they are not all specially constructed for the use of superheated steam. Most of the leading makers of auxiliary engines make the necessary alteration for moderate superheat with but little, if any, extra charge. The mixing of superheated steam with the saturated supply for the winches is also a great advantage, even though very little superheat, if any, gets so far.

The use of superheat on turbines is another and most interesting phase of the subject, and one on which a resume of experience would be most valuable whether on the turbine direct or after passing through the reciprocating engine.

The data on the use of superheated steam during the last three years contained in this paper has been collected by the writer's firm in their professional capacity of consulting engineers to the owners of the steamers. The fact that superheat has been fitted in all their subsequent vessels built, after a careful comparison as judged from the owners' standard of coals paid for, prompted the writer to place this information before the members of the Institution as pointing to the facts:—

1. The economy of coal claimed is maintained.

2. The economy with triple-expansion engines of 2,000 indicated H. P. after being altered to use superheat has been 12.14 per cent.

3. The economy with quadruple-

ECONOMY AND SAVING OF COAL IN TONS PER DAY PER 1,000 I. H. P.

	Pounds per I.H.P. per hour.		Pounds per I. H. P. per hour.	Economy, per cent.	Saving, tons per day per 1,000 I. H. P.
Triple expansion superheated at	1.4	Over triple expansion saturated at	1.6	12.14	2.14
Quadruple expansion saturated at	1.34	Over triple expansion saturated at	1.6	16.25	2.79
Quadruple expansion superheated at ...	1.15	Over triple expansion saturated at	1.6	28.1	4.82
Quadruple expansion superheated at ...	1.15	Over triple expansion superheated at	1.4	17.85	2.68
Quadruple expansion superheated at ...	1.15	Over quadruple expansion saturated at	1.34	14.2	2.03

expansion engines fitted with superheat over triple-expansion similarly fitted is about 17.85 per cent.

4. The wear on the machinery is not appreciably increased where proper lubrication of internal surfaces is maintained.

5. The filtration of oil from the feed water has been successfully carried out, so as to ensure its satisfactory condition.

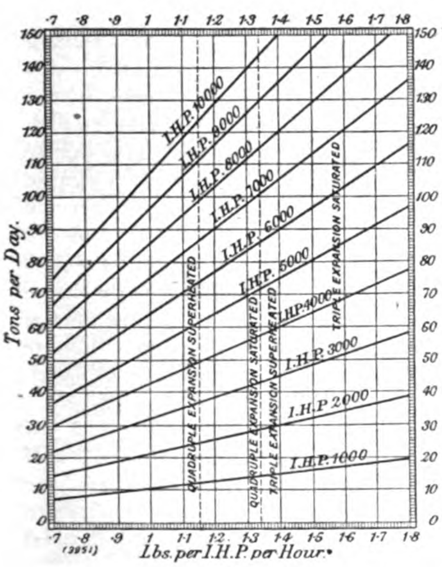
6. No danger from oil getting into the boiler need be feared with a filter such as was used.

7. The arrangement and fitting of the superheater elements and pipe connections present no serious objections.

8. The maintenance of the superheater elements in an efficient condition requires only ordinary attention.

9. In using superheat there is no necessity to carry any additional spare gear.

10. There is no necessity to carry any spare superheater elements.



11. The first cost has been recovered in one year on the basis that the vessel is under steam for 200 days, as a result, not only of the saving of bunker coal, but also of the additional freight carried in lieu of the weight saved thereby. In subsequent years the whole gain is for the profit of the shipowner, subject to, say, 5 per cent of same for additional overhaul and maintenance of the superheater elements, etc., and the usual allowances for insurance and depreciation on first into the engineers in charge, and to see that the working instructions are implicitly carried out.

The number of steamers fitted with superheaters during recent years is an indication of successful working under superheat conditions. The following figures, though far from being a complete record, are worthy of note and consideration:

	No. of steamers.	Total I. H. P.
Hide superheaters	20	......
Yarrow superheaters	13	261,000
Babcock and Wilcox superheaters	29	316,675
Thornycroft superheaters	..	60,000
Schmidt superheaters	1,042	1,322,092

Commerce of Lake Superior

The report of the superintendent of St. Mary's Falls canal shows that 774,520 net tons of freight passed through the canal in April, 1914, as against 1,905,555 net tons in April, 1913, and 166,918 tons in April, 1912. The American canal carried 337,338 tons against 437,182 tons for the Canadian canal. Following is the summary:

EAST BOUND

Articles.	Total.
Copper, short tons	874
Grain, bushels	5,257,074
Building stone, short tons	......
Flour, barrels	214,350
Iron ore, short tons	30,023
Pig iron, short tons	......
Lumber, M. ft. B. M.	1,862
Silver ore, short tons	......
Wheat, bushels	8,147,026
General merchandise, short tons	4,254
Passengers, number	12

WEST BOUND

Coal, hard, short tons	39,244
Coal, soft, short tons	288,576
Flour, barrels	......
Grain, bushels	......
Manufactured iron, short tons	14,554
Iron ore, short tons	......
Salt, barrels	36,224
General merchandise, short tons	20,738
Passengers, number	59

SUMMARY

Vessel passages, number	363
Registered tonnage, net	591,538
Freight:—	
East bound, short tons	406,003
West bound, short tons	368,517
Total freight, short tons	774 520

New Simons Dredger

The Bombay Port Trust, through their consulting engineers and agents, Sir J. Wolfe Barry & Partners, have placed an order with Messrs. Wm. Simons & Co., Ltd., Renfrew, for a very powerful bucket hopper dredger for the improvements of the port and the approaches thereto. It is an axiom with naval architects that the length and beam of modern steamers are only limited by the depth of water in their trading ports, while the cost per ton mile is also determined to a very large extent by the carrying capacity of the ship.

To meet the demand for greater depth of water the Suez canal commission have decided to increase the prevailing depth of water in the canal, the natural consequence of that decision being that port authorities further east than Suez have had forced on their attention the increased and increasing depth of water required by the mercantile marine. The Bombay port trustees by placing the order for this large new dredger, which is capable of dredging to a depth of 50 ft., have shown in an unmistakable fashion that they are very much alive to the needs of the shipping industry.

The new Bombay dredger is to be built on the lines of the U. S. Corozal, which has done excellent work in dredging a very large quantity of rock which had not been previously drilled or blasted. The Corozal was constructed by Messrs. Wm. Simons & Co., for the Panama Canal.

Lieut. Col. E. Eveleth Winslow, government engineer, Norfolk, Va., opened the following bids April 30, for dredging Inland waterway from Norfolk, Va. to Beaufort Inlet, N. C.: Nelson Z. Graves, Philadelphia, Pa., 7 cents; Home Dredging Co., Mobile, Ala., 9.95 cents; Maryland Dredging & Contracting Co., Baltimore, Md., 7.5 cents; F. Sanford Ross, Jersey City, N. J., 9 cents; Norfolk Dredging Co., Norfolk, Va., 10.4 cents; Bowers Southern Dredging Co., Galveston, Tex., 6.9 cents; Eugene Breymann, Toledo, O., 9.25 cents; Atlantic Gulf & Pacific Co., New York; 7.24 cents; The Southern Dredging Co., Mobile, Ala., 7 cents.

Bids were received May 4 by Col. Lansing Beach, Baltimore, for dredging on the east short of Chesapeake Bay as follows: Maryland Dredging & Contracting Co., Baltimore, 16½ cents per cubic yard; Norfolk Dredging Co., 22 cents; N. H. French, Norfolk, Va., 23 cents; River & Harbor Improvement Co., Philadelphia, Pa., 21.8 cents.

The steamer Charles A. Weston ran ashore at Point Sanilac, Lake Huron, during a dense fog and had to lighter part of her cargo to be released. When placed in dry dock at Buffalo it was found that her bottom was very badly damaged and that repairs will approximate $50,000.

J. W. Powell has been elected by the directors of the Fore River Ship Building Corporation, Quincy, Mass., as president to succeed Rear Admiral Frances I. Bowles, resigned. Mr. Powell was formerly assistant to the president at Cramps, Philadelphia.

Harry R. Rogers has been elected a director of the Cleveland & Buffalo Transit Co., to succeed the late R. C. Moody. Mr. Rogers is traffic manager for the company.

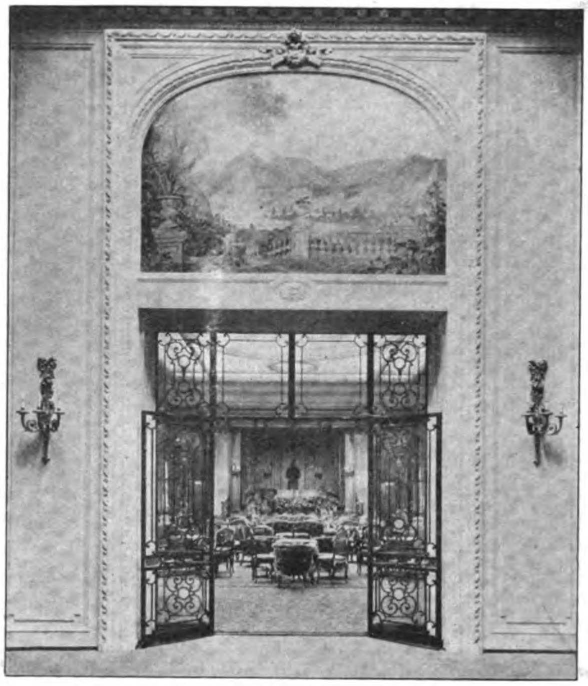
The steamer North Land, owned by the Northern Steamship Co., will sail from Cleveland on her first trip June 18 for Mackinac Island and Chicago.

Steamship Vaterland

For the Present This New Hamburg-American Liner is the Largest Vessel in the World

THE steamship Vaterland of the Hamburg-American Line which arrived in New York May 21 is the largest steamer in the world. While closely resembling her famous sister ship the Imperator in construction and equipment the Vaterland is of greater dimensions and presents many original features. The Vaterland measures 950 ft. in length, 100 ft. in beam and has a tonnage of 58,000. In her trial trip the Vaterland developed a speed of 26.3 knots per hour.

The construction of the S. S. Vaterland was commenced in September 1911 in the yards of Blohm & Voss at Hamburg, and the vessel was launched April 3, 1913. She was christened Vaterland by Crown Prince Rupprecht of Batavia before a notable gathering. The Vaterland is built of the best Siemens Martin steel and conforms in every detail of her construction and equipment to the latest rulings of the German, English and American laws governing ship building. She is constructed with a double bottom and a double skin extending well above the water-line. Her hull is divided by steel bulkheads, both longitudinal and transverse, of exceptional strength. The hull contains five steel decks, which with four superimposed, gives her nine decks above the water line. The Vaterland is equipped with Frahm anti-rolling tanks, which with her natural stability render her one of the steadiest boats afloat.



ENTRANCE TO GRAND SALON, HAMBURG-AMERICAN LINER VATERLAND

An entirely new arrangement of the public cabins has been made possible by the unusual position of the funnels of the Vaterland. The funnels pass through the decks at a point near the side instead of through the centre of the ship. By removing this obstruction it has been possible to have one great cabin open directly into another, thus giving the ship a remarkable effect of artistic spaciousness. This vista extends from the Ritz Carlton restaurant through the winter or palm garden and the grand hallways, to the main lounge or ball room. The grand staircase, which is one of the most attractive features of the Vaterland, extends through six decks. The several staircases are supplemented by three passenger elevators in the first, and one in the second cabin, running through six decks.

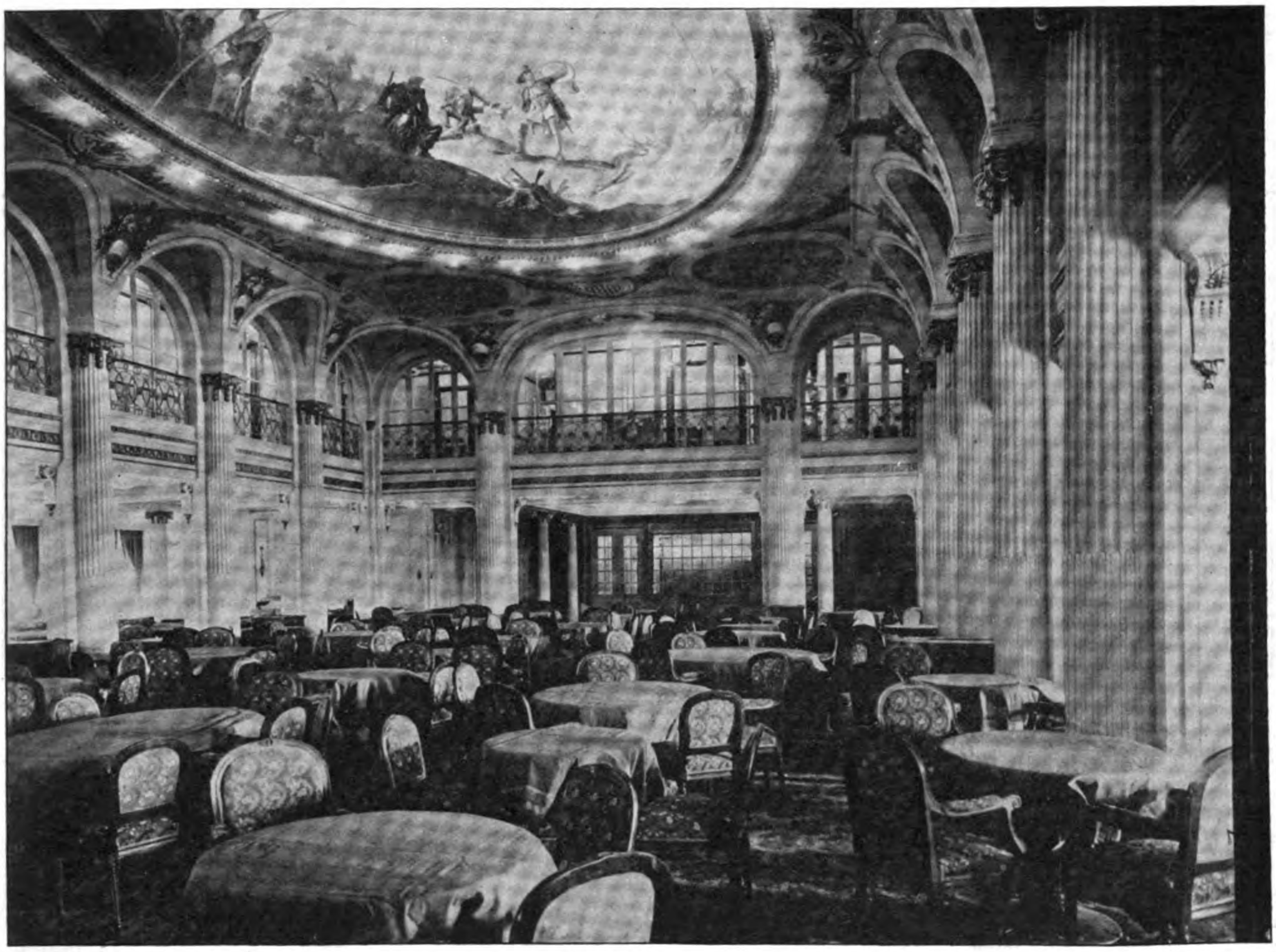
The Vaterland is manned by a crew of 1,234 men. She is commanded by a commodore, four captains and seven officers. There is a chief engineer, three first engineers and thirty-five assistants and electricians. The boilers are operated by 12 chief firemen, 15 oilers, 187 stokers and 189 trimmers. The Vaterland has eight kitchens which are presided over by three chefs, fifty-two cooks, five pastry bakers, 36 waiters and 350 stewards. The crew also includes three physicians and three physician assistants, one female nurse, three telegraphers and three telephone operators, one stenographer and typewriter, a master of the bath, a book seller, cabinet maker, masseurs and a gardener. The Vaterland has a social director as on the Imperator.

The Vaterland is illuminated by about 15,000 electric lights. In no other ship probably is electricity so generally employed. The elevators, both passenger and freight, the hoists, derricks, operating machinery, the kitchens, are all operated electrically. The cabins and staterooms of the first cabin are heated by electricity. An abundance of fresh air is forced to every part of the ship by electric ventilating system. The Vaterland carries no ventilating funnels, common to most ships, thus economizing valuable deck space.

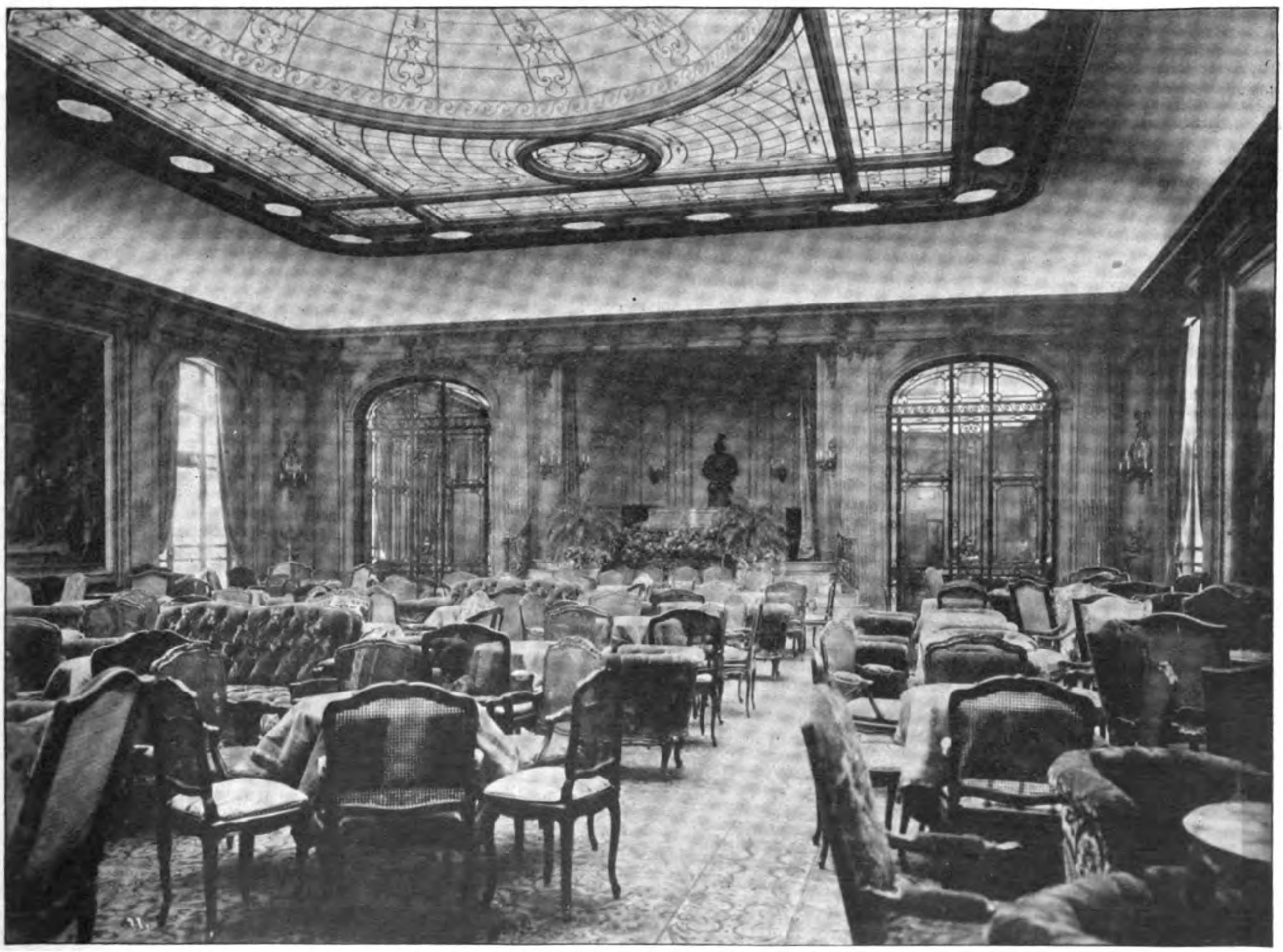
A complete system of telephones, call bells and electric indicating devices assures perfect service in every cabin and stateroom of the Vaterland. At every bell call for instance, a tiny white or red light gleams in the corridor and is not extinguished until the serving steward or stewardess presses the discontinuing button at the door of the cabin from which the call has come. The supply of linen, to mention a single detail of the supply service comprises of 160,000 pieces representing a weight of 85,000 lbs. On a single trip the laundry list contains 10,000 pillow cases, 5,000 bed sheets, as many counterpanes, 30,000 towels and 45,000 napkins.

The Vaterland carries only a few more passengers than ships of half her size. Her public cabins are the largest ever constructed. The main lounge of the Vaterland, the largest and most sumptuous of these cabins, is provided with a concert stage and a dancing floor. The smoking room, located forward, directly beneath the bridge, is open on three sides thus affording an uninterrupted view of the sea and assuring perfect light and ventilation. The main dining room seats upwards of 800 guests. The Ritz Carlton restaurant of the Vaterland is oval in form exactly reproducing the restaurant under the same management in New York. A special feature has been made of the palm garden which is decorated with a wealth of tropical foliage. The ladies' writing rooms, library and lounges are especially large and attractive.

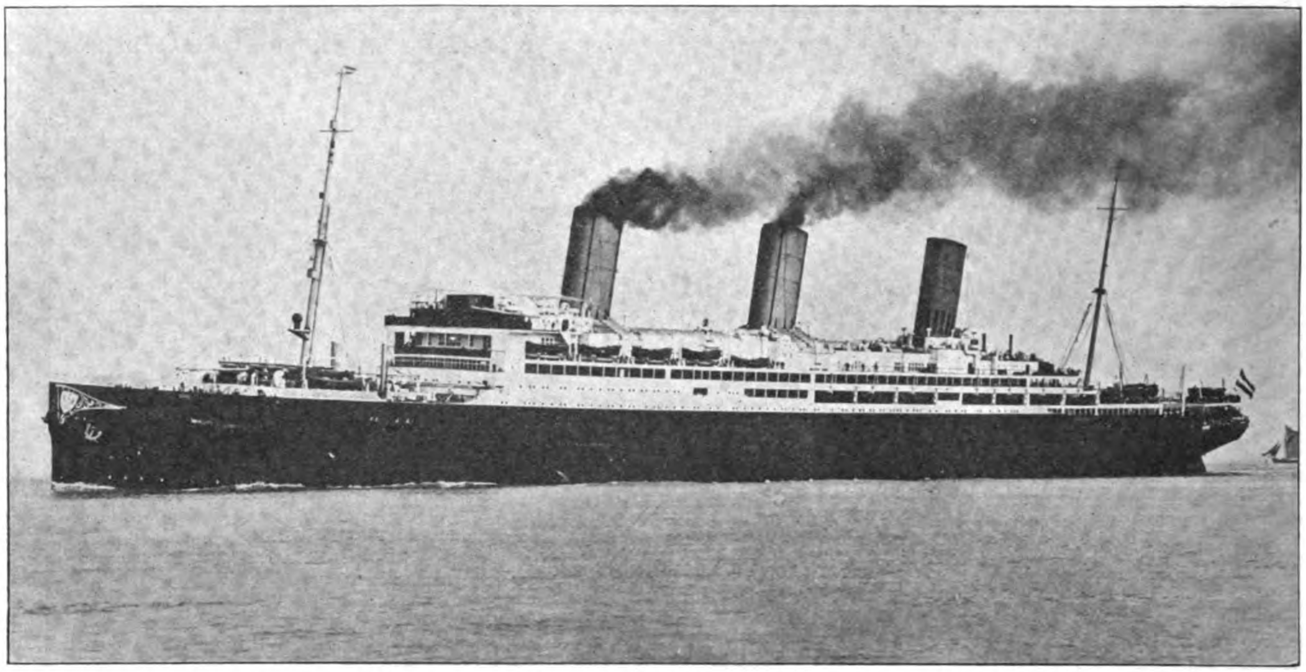
A new attraction is lent to ocean travel by the luxurious baths, enjoyed in such variety on the Vaterland, which rival those of a great spa or bathing resort. The sumptuous Roman



DINING ROOM OF THE HAMBURG-AMERICAN LINER VATERLAND



GRAND SALON OF THE HAMBURG-AMERICAN LINER VATERLAND



THE HAMBURG-AMERICAN LINER VATERLAND

bath which has proven so popular on the Imperator, has its counterpart on the Vaterland. The pool of the bath measures 20 x 40 ft. and has a depth of 10 ft. The bath is carried out with massive columns, Pompeiian frescoes, and is furnished with marble benches. The water is constantly renewed, and special provision has been made to keep the water of a uniform temperature. Grouped about the pool are a variety of therapeutic baths. In this group will be found the ship's barber shop, manicurists, masseurs, hair dressers, etc.

The S. S. Vaterland is propelled by four great screws driven by turbine engines. Each of these propellers measures 19 ft. 7 in. in diameter and weighs 15 tons. When going at full speed the propellers make more than 150 revolutions per minute. The engine plant driving these propellers consists of four main turbines hitched in series. For driving the great steamer astern two special high pressure and two low pressure turbines are provided. All the turbine engines may be used singly. The Vaterland has four firing rooms, with 46 water-tube boilers. As a special precautionary measure the forward engine room is divided into three water-tight compartments, and the aft room into two compartments.

Every conceivable precaution has been taken in the construction and equipment of the Vaterland to assure safety. She carries submarine sounding signals and electrically-driven lead heavers. A searchlight of great candle power is placed high on the fore mast. Loud speaking telephones keep all parts of the ship in instant communication with the bridge. The Vaterland carries life belts for every passenger and member of the crew, with many life buoys and illuminated night buoys. Her life boat equipment includes 83 life boats accommodating about 5,300 persons. Two of these are motor boats carrying special wireless apparatus. Welin davits are used to lower them.

The wireless telegraph equipment of the Vaterland is the most powerful ever installed on shipboard. It comprises three seperate sending instruments and includes six antennae. The special long distance service equipments will keep the vessel continuously in touch with land throughout the Atlantic crossing. A second system will operate over 400 miles a day and 1,200 miles at night, while a third emergency outfit, operated by storage batteries is kept in reserve. The wireless station is in charge of three operators, one of whom is constantly on duty.

Playfair's New Company

The Great Lakes Transportation Co., Ltd., has been incorporated under the Dominion Companies Act, with an authorized capital of $1,000,000, and office at Midland, Ont., to own and operate steam and other vessels and carry on a general navigation business. The incorporators are: H. W. Richardson, Kingston; James Playfair, D. L. White and F. W. Grant, Midland; and W. J. Sheppard, Waubaushene, Ont. H. W. Richardson is a member of the firm of John Richardson & Son, Ltd., Kingston, which owns a number of grain carrying vessels.

James Playfair was vice president and managing director, Richelieu & Ontario Navigation Co., prior to the sale of the properties to Canada Steamship Lines, Ltd. He played a prominent part in the various amalgamations and absorptions leading up to the formation of that company, commencing with the acquirement of the vessels and navigation properties of R. O. and A. B. Mackay, Hamilton, which, with the Midland Navigation Co. and the Empress Transportation Co. of Midland, formed Inland Lines, Ltd., and following on through the negotiations covering the control of the Northern Navigation Co., and the acquirement of the Niagara Navigation Co., and all the various constituent parts of the completed amalgamation. W. J. Sheppard was president of the Northern Navigation Co. for several years prior to its sale to the Richelieu & Ontario Navigation Co.

Capt. Andrew Rattray died at Detroit on May 9, at the age of seventy-two years. He retired from active service about two years ago. His son, Capt. Charles E. Rattray, is master of the steamer J. P. Donaldson.

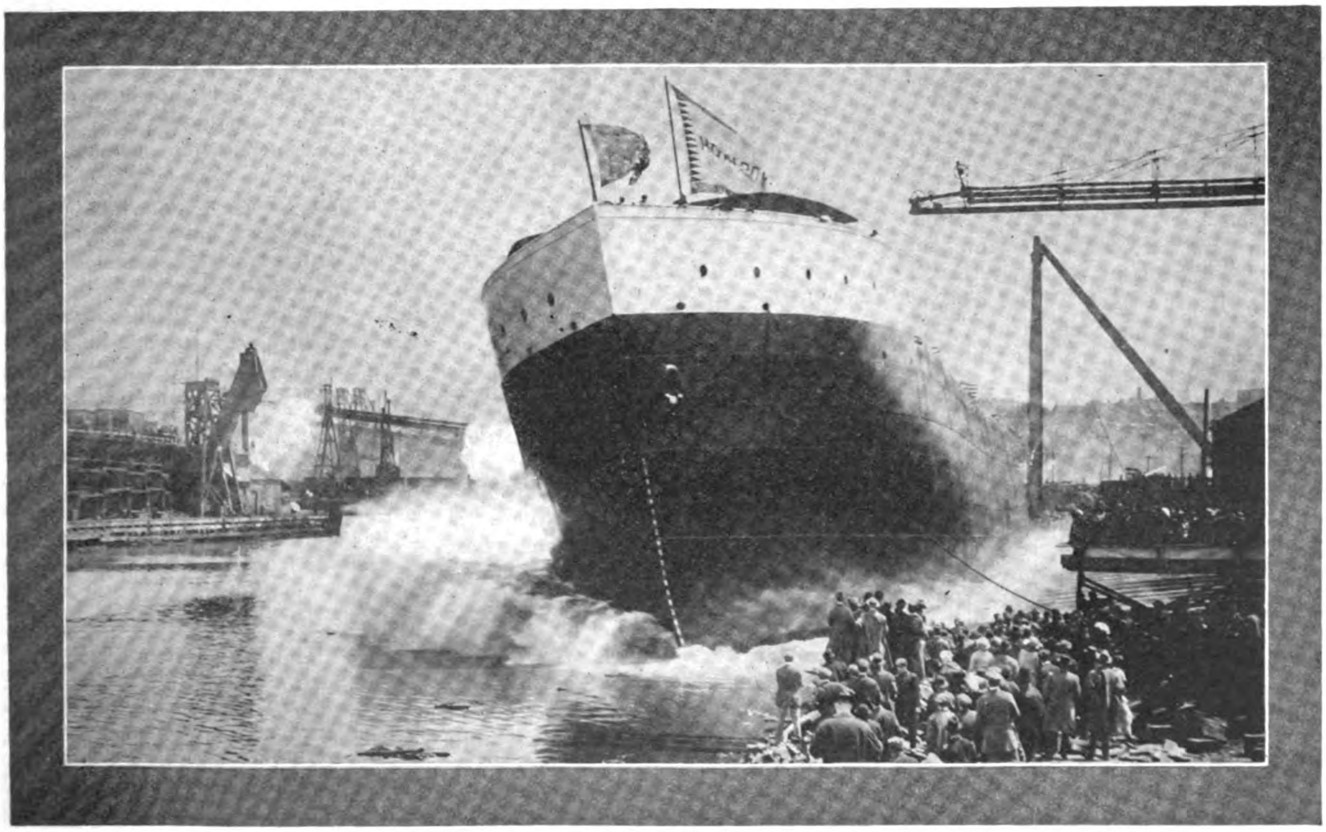
The steamer R. L. Fryer was burned at Marine City and has been abandoned to the underwriters as a total loss. The Fryer was owned by Capt. John Mitchell, of Cleveland, and was insured for about $18,000.

LAUNCH OF STEAMER H. M. HANNA JR.

The bulk freighter Howard M. Hanna Jr., building for W. C. Richardson & Co., of Cleveland, was launched on Saturday, May 9, at the Cleveland yard of the American Ship Building Co., and was christened by Miss Antoinette Paine, granddaughter of Capt. Richardson. This steamer replaces the Howard M. Hanna Jr., which was lost in the great storm on Lake Huron last November, but the new steamer is somewhat larger than the old one. Her length over all is 524 ft., keel 504 ft., beam 54 ft. and depth 30 ft., and she will carry 9,000 tons.

Capt. Richardson has always taken a great personal interest in every ship that he has built, and in this latest steamer he has had incorporated a number of features which from the experience gathered in the great storm of November he believes to be prudent to introduce. The captain has always been an advocate of the 24-ft. center hatch with openings 12 ft. in a fore and aft direction and in fact has for several years built no other kind. In the new steamer the hatch covers are made heavier, being of 15-lb. plate, the coamings raised higher and the Mulholland fasteners are of a special kind to meet the changed conditions. The pilot house is the only part of the vessel that has windows in it. In all other parts of the ship deadlights framed in brass and fitted with glass ¾ inch thick are substituted for windows. As a further precaution, each deadlight is fitted on the inside with a cast iron shutter. The skylight over the engine room is of steel with four deadlights in each section, and the skylight over the dining room is similar. Moreover, all the deck houses are of extra heavy steel, the plating weighing 12½ lbs. per square

CAPT. W. C. RICHARDSON AND MISS ANTOINETTE PAINE, SPONSOR



LAUNCHING THE BULK FREIGHTER H. M. HANNA JR. AT THE CLEVELAND YARD OF THE AMERICAN SHIP BUILDING CO.

foot instead of 7½ lbs. All rivets in this vessel have been increased in size ⅛ inch over the former type. No rivet hole was punched to full size, each hole being reamed to fit the rivet. Altogether the new steamer has been built to withstand punishment and is another instance in which safety has not been sacrito full size, each hole being reamed to fit the rivet. Altogether the new steamer has been built to withstand punishment and is another instance in which safety has not been sacrificed for profit-making. With 300 tons of extra steel worked into her structure, the Hanna will obviously carry 300 tons less cargo.

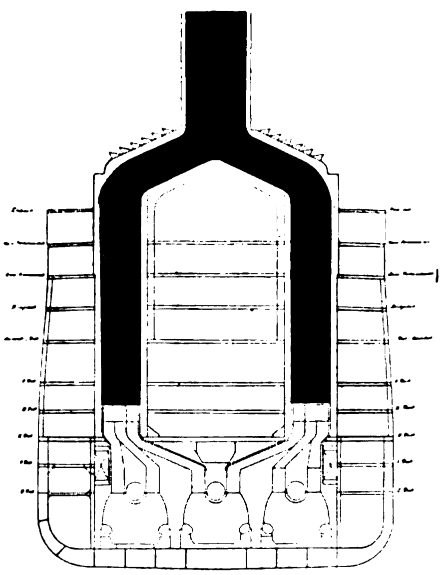
The luncheon following the launching at the Union Club was a highly felicitous affair. Mr. Harvey D. Goulder, who has presided at innumerable functions of this character, acted as toastmaster, and was most happy in his introductions, for in this capacity no man excels Mr. Goulder.

There were many speeches made by experienced speakers, such as Rev. Father O'Reilly, Col. J. J. Sullivan, Judge Wm. L. Day, J. C. Wallace, Edward A. Uhrig, H. N. Herriman, W. H. Higgins, of Wheeling, W. Va., Robert T. Gray, of Detroit, but the address that attracted the greatest attention was that of Capt. Richardson himself, who reviewed his lake career, touching upon the changes during his long life, expressing his views as to what a ship should be and ending with the remark that the Howard M. Hanna Jr. is the last ship that he will ever build. Those present were:

Harvey D. Goulder, F. I. Kennedy, L. E. Dunham, Mr. Hickox, J. L. Forepaugh, H. N. Herriman, Mrs. W. F. Couch, Miss Antoinette Paine, Miss Crossen, Miss Mary Hannigan, Col. J. J. Sullivan, L. B. Miller, H. K. Bourne, Mr. and Mrs. W. S. Talbot, Mr. and Mrs. H. S. Stebbins, F. Taplin, Mr. and Mrs. John T. Kelly, Mr. and Mrs. Tracy H. Paine, W. C. Richardson, W. P. Schaufele, Misses Elsie and Dorothy Schaufele, Matthew Andrews, George Warner, Douglas Brews, Mr. and Mrs. Clarence Richardson, John C. McHannan, Howard Schaufele, C. G. Watkins, A. W. Clark, W. H. Moore, C. E. Cole, Mrs. Harry Lauer, George Hausheer, Harry Humble, Clint Taylor, Frank Billings, James Hendricksen, H. E. Gilpin, L. Stollsteimer, James M. Todd, J. C. Wallace, Robert Wallace, O. J. Fish, Judge Wm. E. Day, Luther Day, Thomas Gary, Allen Smith, Dr. Edward J. Stone, Charles Doty, Capt. Philip Broderick, John Thomson, Arthur Thomson, Mr. and Mrs. Eugene Carleton, J. H. Woods, of Cleveland; Edward A. Uhrig, Joseph Simpson, Mr. and Mrs. W. F. Arden, Milwaukee; Capt. James Davidson, Bay City, Mich.; Wm. H. Pugh, Racine, Wis.; Mr. and Mrs. W. H. Higgins, Wheeling; D. L. Tuttle, Buffalo; Robert T. Gray, Detroit; Richland Packham, Miss Rachel Tracy, Mansfield; Thomas Cheney, D. Cheney, Ashtabula; Capt. and Mrs. John H. Babbitt, Wm. Campbell, Archie Payton, Ashtabula; Michael Connelly, Buffalo; Frank A. Kelley and Mr. Turner, Milan.

Vaterland's Funnels

The quadruple-screw turbine steamer Vaterland, of the Hamburg-Amerika Line, holding the record of being the world's largest liner (58,000 tons), is commended by Captain Ruser, the commodore captain of the Hamburg-Amerika, who formerly held the command of the Imperator. The latter vessel has been in charge of Captain Kier, late of the company's liner Amerika, since March. The Vaterland, it will be readily understood, has many unique features in her construction and equipment. Perhaps one of the most striking of these is that she is the first steamship ever built with smoke-stacks not running through the centre of her decks. About the level of the lowest passenger deck her funnels are divided into two smoke-tubes, which run up either side of the ship, and rejoin on the upper boat deck to pass into the funnel. The space occupied by ordinary funnels passing through the middle of the decks is thus left clear, and the passengers will occupy the full deck without obstruction. This will give a long central corridor on each of the passenger decks.



HAMBURG-AMERICAN LINER VATERLAND'S UNIQUE SMOKE STACKS

Steamship Glenroy

The steamship Glenroy owned by the Royal Mail Steam Packet Line, extensively damaged by fire at Portland in March, has been completely rebuilt at the yard of the Seattle Construction & Dry Dock Co. well within the contract time of thirty-one days. The contract was secured by the Seattle Construction & Dry Dock Co. in competition with the principal shipyards on the Pacific coast, the time and price for doing the work being very much less than that of the competitors. The contract for the repairs was one of the largest handled on the Sound for some time. Seventy-one plates were taken off, faired and returned, 25,000 rivets removed and replaced. All joiner work in the vessel was renewed, new bridge house built, flying bridge, captain's house and chart room all renewed; poop deck house renewed, port side of fidley rebuilt, nearly all of the interior furnishings of the super-structure replaced, new teak deck laid.

Ordered New Steamer

The Canadian Steamship Lines, Ltd., has ordered from G. T. Davie & Sons, Levis, Que., a single screw ferry boat, to be called Longueuil, and to replace the present boat of that name. Her dimensions will be:—length over all, 169½ ft.; extreme beam, 43 ft. 2½ ins.; depth moulded, 12¼ ft. She will have one Scotch marine boiler, and the engine will be fore and aft compound, 17-34 x 36. She will be built to Lloyds requirements, and will be constructed suitably for ice breaking conditions. She will be practically fire proof, all decks and superstructure being of steel. She will be fitted with all conveniences, and will be of a type representing the most modern ideas in ferry steamboat building. The machinery to be installed in this vessel, is being transferred from the company's steamer Dundurn, which has been dismantled at Polson Iron Works, Toronto.

The Anderson Steamboat Co., Seattle, has submitted the lowest bid at $91,500 for the construction of the Kirkland ferry. Other bidders were: McAleer Shipbuilding Co., $94,510; Seattle Machine Works, $105,000; Seattle Construction & Dry Dock Co., $95,000; F. Duthie & Co., $91,999.

Lee Sand Blast Machine

An Economical and Effective Method of Removing Scale and Barnacles from Ships' Bottoms

THE use of the sand blast has become quite widely recognized in recent years as one of the most economical and effective methods of removing scale and barnacles from ships' bottoms. Since the publication of the original article on this subject, in THE MARINE REVIEW of January, 1911, it has been adopted with uniformly satisfactory results by ship yards all over this country. In this article there was set forth a description of a "Kelly" sand blast machine which had been used successfully in cleaning scale from the hull of the new steam yacht Emrose. Since then, several important changes in design have greatly improved and augmented the capacity of the machine, and it is now referred to by the manufacturer, Arthur E. Lee, 30 Church street, New York, as the "Lee multiple nozzle, positive, continuous feed, sand blast apparatus."

Most important of the new features is the addition of three more nozzles, making it possible to operate four sand blast streams simultaneously from the same machine, as shown in Fig. 2. One machine thus does the work for which four formerly were required, while for operating the machine itself and the four nozzles, the labor of five men only is required, where formerly eight would have been employed. This increase in the capacity was made possible largely by the special type of sand feeding device peculiar to this machine. This device consists of a revolving wheel, located horizontally at the bottom of the sand chamber, the periphery of the wheel being grooved, or slotted, much in the same manner as an ordinary gear wheel. As the wheel revolves, the sand falls into the grooves, being carried around until it comes into the path of a current of compressed air, which catches it up and conveys it to the entrance of the hose leading to the sand blast nozzle. The addition of the three hose connections, therefore, simply entailed the passage of three additional compressed air currents through the grooves of the feed wheel.

Another change which is embodied in the improved design makes it unnecessary to halt the operation of the machine temporarily while replenishing the supply of the abrasive. The sand chamber, which formerly was a unit, has been divided into two compartments, as shown in Fig. 3; each of these compartments may be made air-tight by means of a cone-valve entrance. The sand charging operation is conducted as follows: The sand is shoveled into the top compartment and the top cone-valve closed by means of an external lever, after which compressed air at the regular working pressure is introduced into the top compartment. Next, the lower cone-valve drops automatically, permitting the sand to flow from the upper into the lower compartment, and the lower cone-valve then is hoisted back into place and held there by means of a second external lever, until the air in the upper compartment has been exhausted into the atmosphere, by means of a three-way cock, when the pressure in the lower compartment automatically holds the cone-valve in its seat. By means of this double air-locking device, the supply of sand may be renewed constantly without interfering with the regular operation of the machine.

The sand which is charged into the container must be sieved through a 10-mesh screen in order to free it from lumps or stones which might obstruct the free passage through the hose. Then too, it is advisable to use perfectly dry sand, although comparatively damp sand may be used without clogging the hose. The flow of sand from the sand chamber to the sand blast nozzle may be regulated automatically by changing the speed of the air motor which operates the feed wheel. The capacity of the sand containor, five cubic feet, is sufficient to enable the machine to operate with all four nozzles on one charge for 27½ minutes. For one nozzle, used independently, one charge will last one hour and 50 minutes.

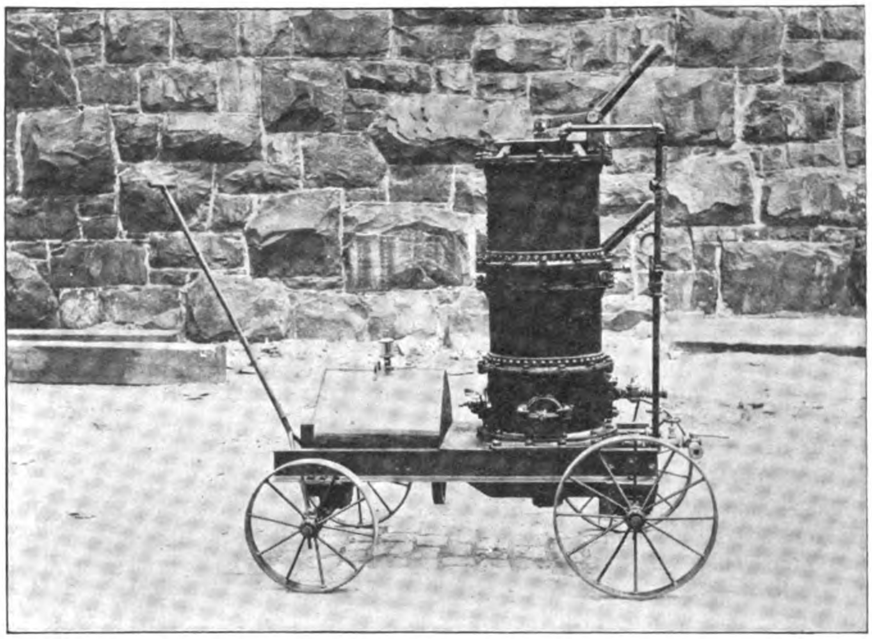


FIG. 1—LEE PORTABLE SAND BLAST MACHINE AS PROVIDED WITH CONNECTIONS FOR OPERATING FOUR SAND BLAST STREAMS

The machine consumes compressed air at the rate of 60 cubic feet of free air per minute for each of the four nozzles, and 25 cubic feet in addition for the air motor. The pressure required at the nozzles for the most efficient operation is 80 to 90 lbs. per square inch, but for the propulsion of the sand from the machine to the nozzle, 30 to 40 pounds pressure is sufficient. The pressure can be throttled down as desired by means of an ordinary air valve which is furnished. The air used for carrying the abrasive from the machine to the nozzles is passed through a slotted baffle plate, or separator, at the intake, which arrests the moisture. The water of condensation which thus accumulates may be removed by

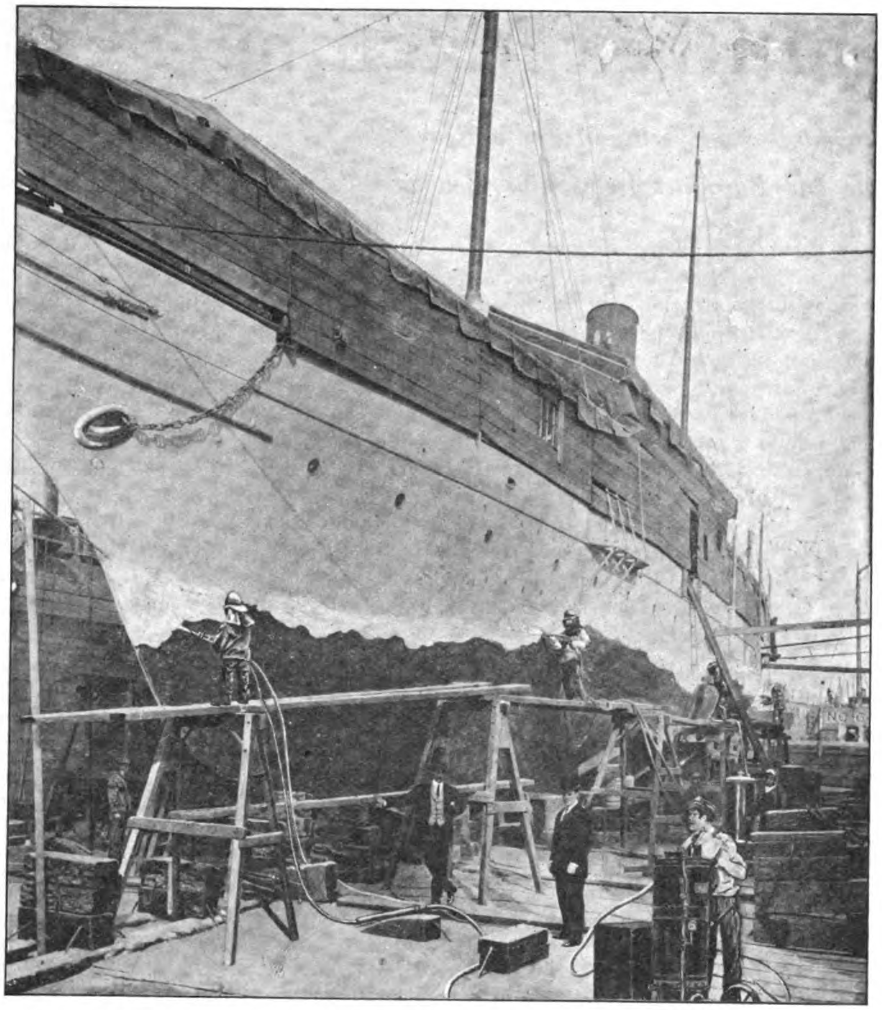


FIG. 2—CLEANING HULL OF STEEL YACHT WITH FOUR-NOZZLE SAND BLAST MACHINE PREPARATORY TO REPAINTING

means of a drain cock at the bottom of the separator.

The sand, by reason of the low pressure in the machine, is carried to the sand blast nozzle at comparatively low speed, doing away with much of the wear which generally results from the passage of abrasive particles through the hose and connections. On entering the nozzle, the stream of sand is picked up by a current of air which enters from an independent hose connection, under higher pressure and at much greater velocity, and the abrasive thus is impinged against the surface to be cleaned at the maximum velocity. The nozzle which is employed is of the Kelly type, consisting of the nozzle frame, to which the hose connections are attached, and the tip and tip holder which fit into the nozzle. Recently Mr. Lee developed a new form of resilient tip, which takes the place of the old tip and tip holder. This, it is claimed, will stand up under the work for several days. Another advantage of the resilient over the steel tip is that the discharge opening does not increase in diameter so rapidly with friction and hence the air consumption is kept at a more constant rate. Where the supply of air is limited, this is an important feature, since the rapid enlargement of the circular area of the nozzle orifice must result necessarily in decreased cutting power of the abrasive. When desired, special nozzles can be furnished which create a spray of atomized water to kill the dust generated by the sand blast stream.

The cleaning capacity of the sand blast machine is 10 to 20 sq. yds. of steel surface for each nozzle per hour. The sand blast is equally effective in cleaning old steel hulls, preparatory to repainting, and in cleaning mill scale off the hulls of new vessels prior to applying the initial coat of paint. The machine is portable, being mounted on a four-wheeled truck which easily can be moved by one man. It may be used wherever an air supply is available. The sand blast may be used effectively with the nozzles elevated as high as 150 ft. above the level of the machine.

The steamer City of Rome, burned to the water's edge off Ripley, N. Y., on May 7, was abandoned to the underwriters as a total loss. The City of Rome was built at Cleveland in 1881, and was formerly owned by the Gilchrist Transportation Co. She was purchased by George M. Steinbrenner and James Mitchell about two years ago.

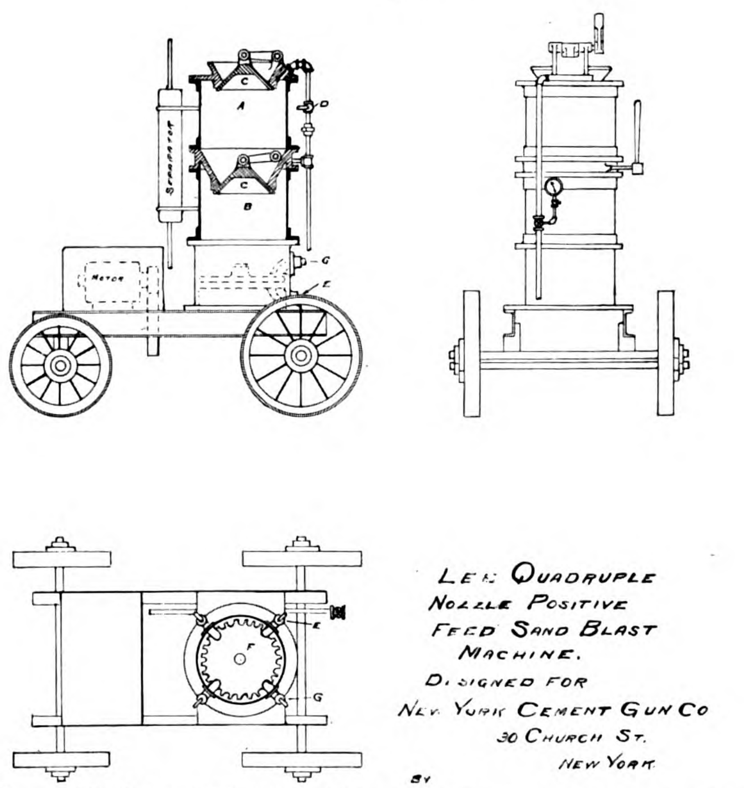
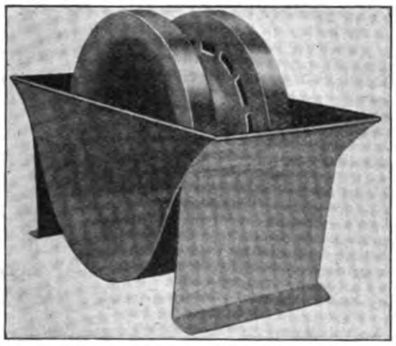


FIG. 3—TOP, SIDE AND BACK DETAILED VIEWS OF FOUR NOZZLE SAND BLAST MACHINE

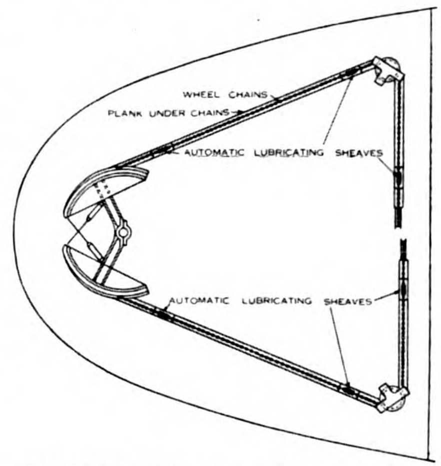
Mulholland Lubricating Sheave

Capt. Matthew Mulholland, of the steamer M. A. Bradley has a natural turn for mechanics and when not sailing is inventing some useful appliance. His hatch fastener is well



known and is commonly held to be the best in use. During the past winter the captain has developed a life boat releasing device which makes it possible to instantly release a life boat in the saddles in all weathers, no matter how badly the ship may be listed or how she is rolling. In this device the usual lashings are dispensed with, one movement releasing the clamping device and freeing the boat.

Another invention of the captain is a lubricating sheave which is intended to keep the quadrant chain perpetually working in oil, though, of course, it will perform the same service for wire cables in mines. There is certainly nothing more essential aboard ship than the care of wheel chains, especially on the great lakes where the channels are narrow and where the parting of the chain inevitably means stranding. The sheave is illustrated in the accompanying line and wash drawing. The oil is held in a reservoir of malleable iron in which the sheave works, filling its hollow cups as it revolves and throwing the oil out on top of the chain nearly in the center of the link. The reservoir is ordinarily 8 x 24 in. and the sheave 12 in. From four to six sheaves are advised for wheel chains. Fig. 1 shows the base of the reservoir and in part the sheave and steel pin. The flanges are placed on top of the sliding board that is usually used on board ship. Fig. 2 shows the reservoir with the chain passing the sheave and the manner in which the reservoir can be drained for cleaning. Fig. 3 shows the sheave, the pin and the hanging adjustment rods. Fig. 4 shows the inner view of the sheave and the hollow cells. The sheave is



ARRANGEMENT OF SHEAVES ON WHEEL CHAIN

guaranteed to greatly prolong the life of the wheel chain. In fact, wheel chains that have been lubricated with it during the past two years have shown no wear at all. The sheave is being handled by the Mulholland Hatch Fastener Co., Marion building, Cleveland.

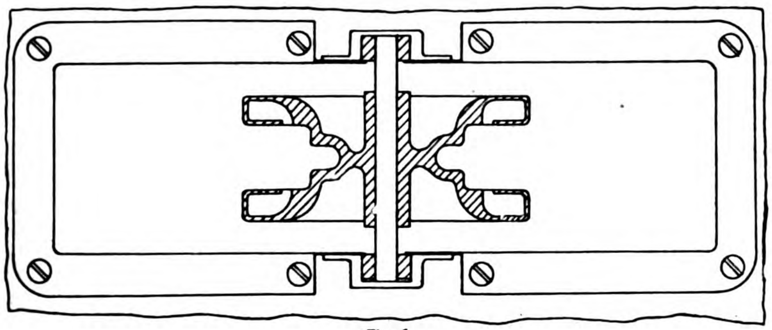


Fig. 1.

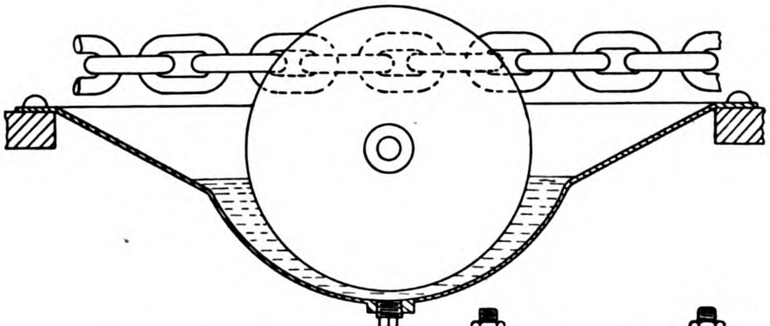


Fig. 2.

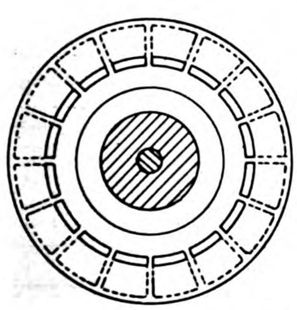


Fig. 4.

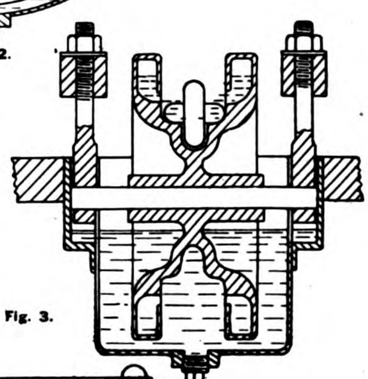
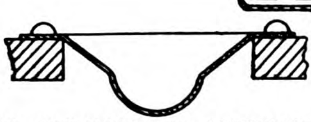


Fig. 3.



SECTIONAL DRAWING MULHOLLAND LUBRICATING SHEAVE

John W. Ferguson Co., Paterson, N. J., has just been awarded the contract for the new five-story and basement storehouse for finished goods, adjoining the jute mill of the Columbian Rope Co., Auburn, N. Y. This storehouse, which is from the designs of Charles T. Main, Boston, measures about 120 ft. each way, the shape being that of a trapezoid. It is to be constructed of reinforced concrete with mushroom columns on the inside and with brick walls outside. Every precaution has been taken to prevent the spread of fire in the inflamable goods to be stored, including automatic sprinklers throughout, and automatic fire doors at every place where the partitions are pierced.

Lightship No. 82, stationed at Point Abino, Lake Erie, which foundered during the gale of Nov. last, has been located by the government steamer Surveyor near her former station.

Capt. James H. Buchanan died at his home in Detroit following an operation on May 9. His last command was the steamer Louisiana.

Isherwood System of Construction

*Showing Very Graphically the Amount of Work That Can be Put Together in a Great Lakes Shipyard**

By Robert Curr

THE plan accompanying this article shows the amount of work put together in a great lakes ship yard in a few hours.

As is shown by plans the bottom plating to *E* strake is erected with all the interior work.

Assuming that the foundation of the building berth is sound, the keel blocks have to be laid to a suitable height so that the rivets in the bottom can be driven.

The keel blocks are simply cuttings from pine logs 16 in. to 12 in. square. The cuttings are built up to a height of 4 ft., the bottom piece being about 5 ft. long and the top 12 in.

The top of the blocks are perfectly level and a straight line scored in on the middle of the completed blocks.

The blocks are spaced 5 ft. apart and braced in a way that with ordinary care will not be pushed out of place in landing the keel plates on them.

Center lines are punched or nicked in on the keel plates and are a guide in keeping the keel plates straight when erecting. This line as a rule is on both sides of the plate before erecting so that the line on the underside will be laid on the line on the keel blocks. If the butts of the keel plates are planed square there is no trouble in getting the keel perfectly straight.

After the keel plates are erected the next strake *B* is put up, which makes good footing for the men in erecting the center keelson.

By the time the center keelson is erected and riveted the bottom plating is in place as seen by plans.

The longitudinal frames follow up with the strakes of plating they are on. The bottom plating has a rise of 3 in. in the half width and this is tested by applying a straight edge under the bottom, the plating being shored up to that height above the level board.

When the plating is shored up to its proper place the transverses and watertight floors are dropped into place which are the means of fairing up the bottom.

The bottom plating being four transverse spaces long it gives' a splendid opportunity for the shift of butts of all the plating forming longitudinal members. The 10 ft. shift of butts here is not necessary for half that distance will show that the shearing of the rivets in the plating is even greater than the plating between the frames.

The keel plate, center keelson and rider plate form a girder and are considered the backbone or at least a structural part of special importance.

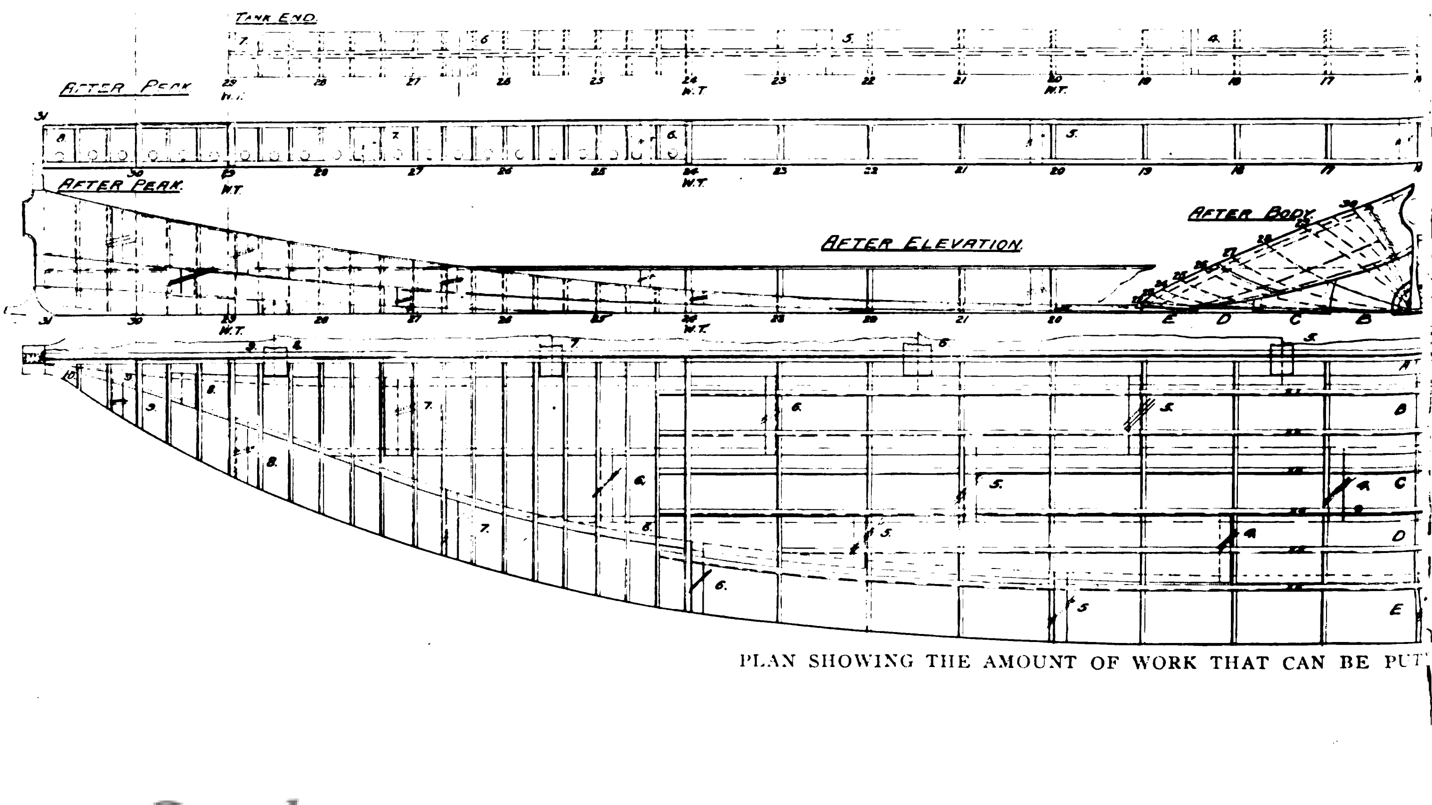
The center keelson and the rider plate are shown above the body plan and as the butts are clear of each other about 10 ft. there is no need of dwelling on that point at this time.

The center keelson like the keel plate is continuous from the stem to the stern post and the rider plate is continuous all the length of the tank from bulkhead No. 2 to after end of tank No. 29.

The keel plate should be as wide as to have at least two rivets between the edge of the next strake and the toe of the keel angle.

Considering the water tight floor angle to the shell as a point in view the section thro' No. 12 shows this

*This is the thirteenth of a series of articles on the Isherwood system of construction which began in the September, 1912, issue of THE MARINE REVIEW. The first article dealt with the general specifications of the steamer, the second with the sheer, half-breadth and body plans; the third explained the method of getting the sheer; the fourth dealt with the longitudinal and transverse framing; the fifth with offsets; the sixth with the shell plating; the seventh with the shell plating expansion; the eighth with the arrangement of plates and angles forming the spar deck; the ninth with the transverses; the tenth with bulk head construction; the eleventh with the connection of longitudinal frames to the bulkheads and transverses; the twelfth showed the interior framing between the tank top and spar deck.



PLAN SHOWING THE AMOUNT OF WORK THAT CAN BE PUT

arrangement and to do this it is necessary to have a plate 37½ in.

The rivets are ¾ in. diameter and as six diameters of the rivets apart is ample for making this water tight floor tight and resist the water pressure to the load water line. The riveting is arranged through the center keelson with the same pitch.

Section through No. 12 shows the riveting as arranged and all the sections forming the girder.

The watertight floor here shown is of no importance in this consideration but it shows that no precaution has been taken to make this other than the weakest section for it will be observed that the watertight transverse member is joggled over the top and bottom angles on the center keelson.

The keel plate is 37½ in. wide x 11/16 in. thick and by deducting 10 rivet holes 1 in. long leaves a valuation of 18.875 × 26 tons per square inch = 490.75 tons. Example: Keel plate 37.5 in. × 11/16 in. — 10 rivet holes 15/16 in. diameter countersunk equal to 1 in. lost area. 37.5 — 10 in. = 27.5. 27.5 × 11/16 in. = 18.875 sq. in. 18.875 × 26 = 490.75 tons tensile strength of keel plate at weakest part.

Center keelson is 36 in. deep x 6/16 in. thick with top angles 3 in. x 3 in. x ⅜ in. thick and bottom angles 4 x 4 in. x 7/16 in. thick. There are eight rivet holes punched out in the plate, reducing the plate to 36 in. — 8 × 13-16 in. = 29.5 in.

The area of the plate = 29.5 × ⅜ = 11.06 sq. in.

The area of the angles = 7.58 × 7/16 × 2 = 6.62 — 1.75 for rivet holes = 4.87 sq. in.

Top angles 11.25 × ⅜ = 4.22 — 1.22 for rivet holes = 3 sq. in. Rider plate is 41.5 in. wide and by deducting ten countersunk rivet holes leaves 31.5 in. 31.5 × 7/16 × 26 = 357.5 tons tensile strength. Strength through keel, center keelson and rider plate is:

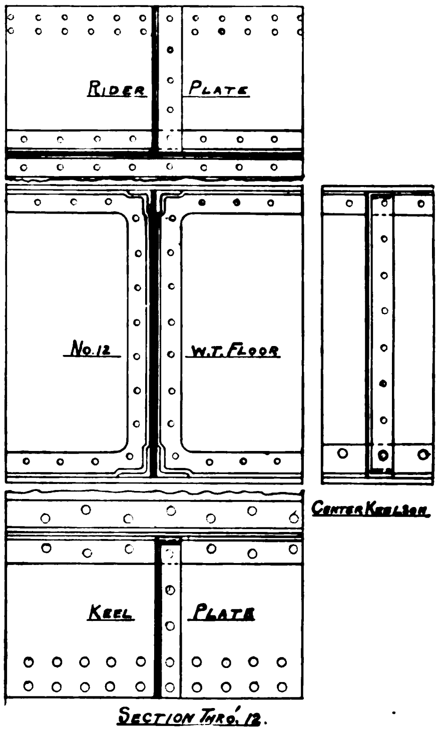
	Area of section.
Keel Plate	18.875
Center Keelson	18.93
Rider Plate	13.75
Total	51.43

	Tensile strength in tons.
Keel Plate	490.75
Center Keelson	492.18
Rider Plate	357.50
Total	1340.43

The steamer George F. Baker, of the Pittsburgh Steamship Co.'s fleet, downbound from Ashland with ore, has the misfortune to run ashore near Eagle river, Lake Superior, during a dense fog on her first trip of the season. The wrecker Favorite was rushed to her and after jettisoning about 1,000 tons of ore, was released and taken to Portage for an examination. She later delivered her cargo at Fairport and went to Lorain for repairs.

The steamer Benjamin Noble foundered with all hands off Duluth on her first trip of the season. Lake Superior was swept by a heavy northwest gale, accompanied with snow, and the Noble was apparently unable to make out the harbor lights. It is believed that she tried to turn around and foundered in doing so. The Noble was of Canadian canal dimensions and was built by the Detroit Ship Building Co. at Wyandotte in 1909.

Geo. M. Black, secretary and treasurer of the Detroit & Cleveland Navigation Co., died at Detroit on May 5. He had been for many years actively identified with a number of Detroit enterprises.



The Racine-Truscott-Shell Lake Boat Co., Muskegon, Mich., launched the cruiser Monomey for the United States Engineer's Office on May 5.

OGETHER IN A GREAT LAKES SHIP YARD IN A FEW HOURS

Turbine Reduction Gear

Description of the Remodeled Arrangement on Board the Collier Neptune

THE results of the trials of the original installation of the original propelling machinery of the collier Neptune with its reduction gear, while demonstrating beyond question the adaptability of reduction gears for marine work, showed that some modifications of the turbines and reduction gears would give much better results. It was decided, therefore, to replace the propelling machinery, and the following description applies to the remodeled arrangement.

One of the most important points shown by the trials, was that the revolutions of the propeller were too high for a vessel of the collier's form, the original revolutions at 14 knots being 135, and those of the turbine 1,220, whereas a far more efficient propeller is obtained by reducing the revolutions at 14 knots to 110. Also a considerable increase in economy of the turbine is possible by increasing the revolutions from 1,220 to 1,910, which is the next most important change that has been made.

No doubt the greatest divergence from accepted marine standard and practice in the original installation in the Neptune, was in the method of control of the turbines, they being under the control of the navigator on the bridge, as well as from the starting platform. To marine engineers and navigators, such an innovation probably appeared unnecessary and fantastic, and too great a step aside from the trodden path to be safely employed; and that such feeling existed, and probably still exists in the minds of some engineers, is shown by the hostile criticism of the bridge control.

However, after the trials of the Neptune and months of service, the bridge control has shown itself to be absolutely reliable, and after becoming accustomed to it, those having experience with it have come to use it in preference to the ordinary engine room telegraph which was, of course, a part of the Neptune's equipment.

During the service of the Neptune a number of occasions arose in which the advantages of the bridge control were shown in a very striking manner. This is brought out in the report of Lieut. W. W. Smith, U. S. N., who was in charge of the Neptune's machinery, and from which we quote as follows:

"The bridge station has been used in steaming, in going alongside ships and in docking. While steaming it requires

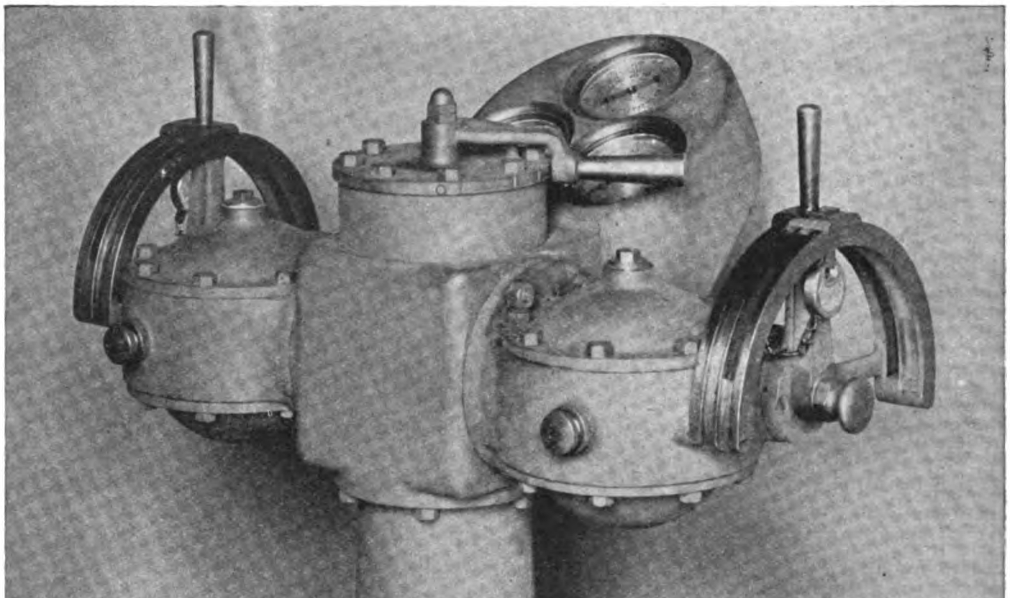
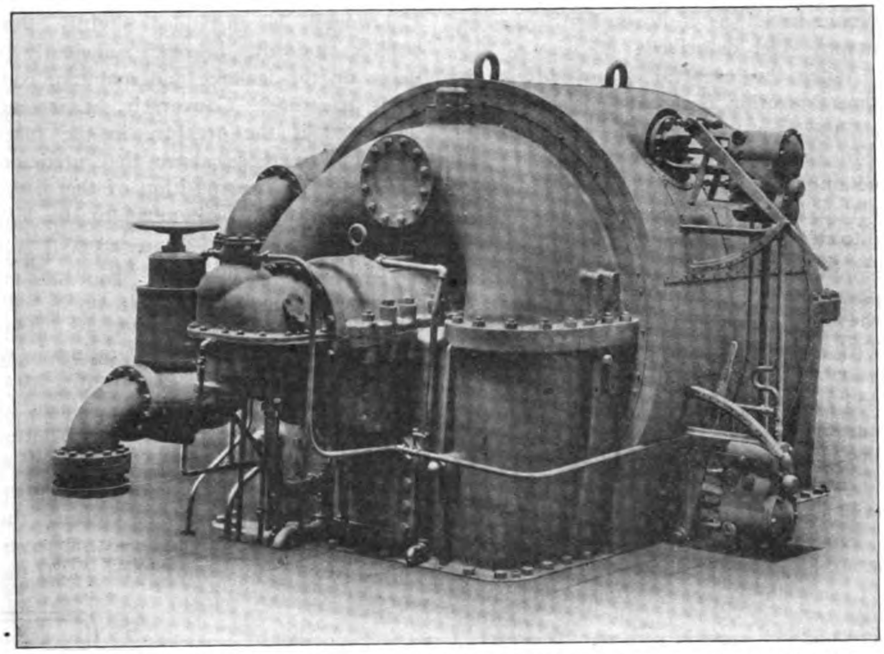


FIG. 3—BRIDGE CONTROL STAND



PORT TURBINE, LOOKING AFT, SHOWING GOVERNOR AND OIL RELAY CYLINDERS

practically no attention as the regulation is automatic. The speed has been regulated accurately, but not as accurately as desired. Unfortunately there has been no opportunity for steaming in formation, but I have no doubt of the suitability of the control system for this purpose. In maneuvering, in coming to anchor, going alongside, etc., the regular bridge detail has handled the turbines without difficulty. In this connection, attention is invited to the fact that none of the deck officers are experienced in engineering. In fact, they have no knowledge of it. If men of this type can use the bridge control, there should be no difficulty on a naval vessel. In maneuvering, the control gear has operated satisfactorily. The indicators show the operator what the turbines are set to do, and what they are doing. Gauges show the air and steam pressure available. The gauges and indicators have special dials so that the indications can be understood by an untrained man. With this control gear, it is as easy for one man to operate the engines of a battleship as it is to run an automobile.

"Under service conditions, there is a saving in time in operating from the bridge of from 2 to 6 seconds which depends principally on the engine room operator. Under test conditions of course this would be less. To the officer on the bridge it gives confidence to know that the propellers are entirely under his control, that the control gear operates quickly and exactly the same each time. There is no doubt as to whether the signal is being answered properly and promptly. There is no one over whom he has no control to use discretion to keep the steam up when the ship is in a dangerous position. In case of emergency, the officer on the bridge can best decide whether it is best to save steam or a collision.

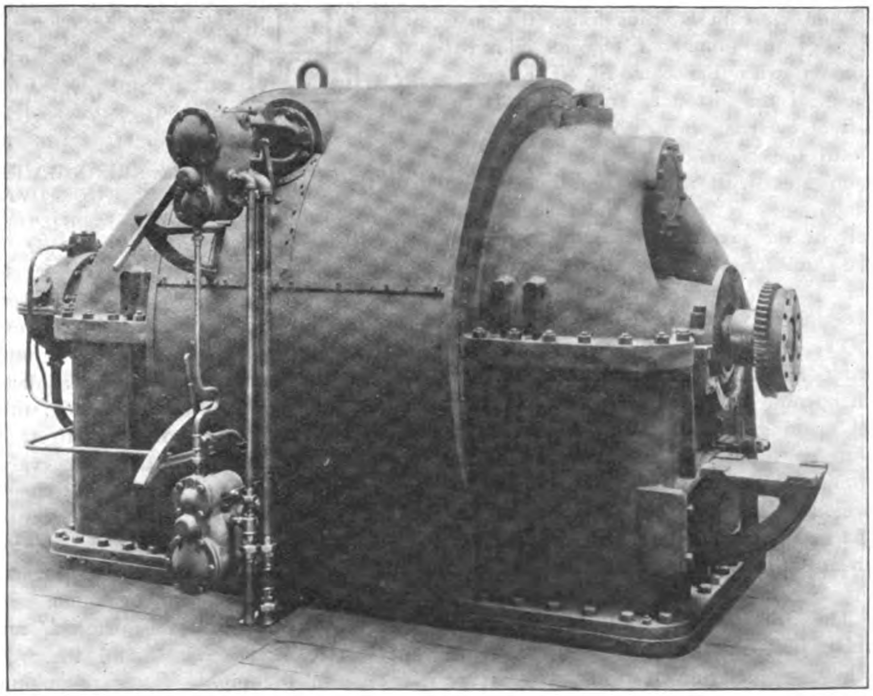
"In two instances it was necessary to increase the speed suddenly to avoid collision. The steam pressure dropped very low and some of the auxiliaries were about to stop. The engineer protested vigorously against such unwise operation. He, not knowing the danger, would probably have eased up to save steam, and collision would have resulted.

"During one voyage the propellers came out of water so that excessive racing would have occurred with ordinary machinery. Most of the time they came half-way out and frequently they came practically all the way out. Due to the action of the governing mechanism racing was prevented. The speed increased and decreased slightly—about four per cent estimated. The turbine inlet valves were opening and closing continuously and at times they were entirely closed. Quick operating valves are necessary to effectively prevent racing. This feature of the control system is of importance because it will enable a vessel to steam at considerable speed in heavy weather.

Reliable Control

"After being modified, the control system has been thoroughly reliable. Even if the bridge control should fail, it only requires a few seconds to change to the engine room. This feature has been frequently tested and found satisfactory. However, with the improvements which will be made in accordance with the experience gained with this, the first installation, I am convinced that operation from the bridge will be absolutely positive and reliable under all conditions. In my opinion, it will be more reliable than the telegraph, although the latter is good in this respect. As the general principles are the same, there is no reason why it should not be as reliable as the air brake, or even more so as the service is less severe."

The bridge control system which will be installed with the new turbines and reduction gears now under construction for the Neptune, has been thoroughly tested out on a small marine turbine in the shops of the Westinghouse Machine Co. and found entirely satisfactory, obviating entirely troubles which it was



PORT TURBINE LOOKING FORWARD SHOWING GOVERNOR AND OIL RELAY CYLINDERS

thought might possibly arise in the control mechanism first installed, although the latter has never developed any of the difficulties which it is possible to conceive might arise. In principle the control is much the same as previously described in *Engineering,* though some of the parts have been eliminated, and the apparatus much simplified.

The medium used for transmitting to the engine room the movements of the control handle on the bridge, is air, as previously employed, and the actual operation of the relays moving the steam valve, is oil.

A diagrammatic arrangement of the operating parts of the control system, including the bridge valve and steam nozzle valves, is shown in Fig. 1. As will be seen from examining the left-hand part of the illustration, the bridge control lever D' is movable in two quadrants A' and C' with an offset B' parallel to the axis of movement.

When the control lever D' is at B' both the ahead and astern nozzles are closed. The operating handle D' turns a shaft carrying a cam E' which has pressed against it the point of a small valve F'. The valve F' is hollow and closed at both ends, and has two sets of ports, G' and H', the former always being in communication with the source of high pressure air supply (furnished by a standard Westinghouse air brake compressor), and the latter having its edge to the extreme left, just line in line with the ports I' in the piston L'. The end of the plunger valev F' is line in line with left-hand edge of the ports I'. A small spring K' within the piston L' is provided to maintain a positive contact between the point of the plunger F' and the cam E', thus fixing the position of the plunger F' by its point of contact with the cam E'. The movement of the piston L' to the left is resisted by the spring N'. The space J' to the right of the piston L' communicates with space Q' between two diaphragms R' R' and the space to the left of the piston L' communicates with the atmosphere. A communication to the passage within the piston L' to atmosphere is provided by the ports M'.

The diaphragms R' R' control two valves T' and U', the former controlling an opening to atmosphere, and the latter an opening to the source of high pressure air supply. The spaces S' S' are connected by a passage, so that the pressure in them is always equal. The space S' communicates either with the ahead or the astern operating relay in the engine room.

The function of the bridge control valve just described is simply to maintain a predetermined constant pressure in the air relay cylinder, and this is accomplished as follows, with the apparatus just described:

When the lever D' is moved from its central position, B' in the ahead quadrant A', the cam E' pushes the valve F' to the left, thereby bringing the port H' into communication with the port I' in the piston L'. This admits high pressure air into the space J', and consequently Q'. As the pressure in the space J' increases it will quickly force the piston L' to the left, until the right-hand edge of the port I' cuts off communication with the port H', or should there be leakage, it will take a position such that the opening through ports H' and I' would be just large enough to pass sufficient air to make up for the leakage and maintain a constant pressure in the space J'.

Since normally the spaces S' S' are at atmospheric pressure, when the pressure between them in the space Q' is increased, the diaphragms are forced outwards, closing the valve T' and opening the valve U', thus admitting high pressure air into the space S' S' until the pressure in the latter is equalized with the pressure in the space Q', thus bringing the diaphragms back to their normal position, permitting the valve U' to seat and thus cut off the supply of high pressure air. The pressure existing in the space S' is transmitted to the space P to the left of the air relay cylinder in the engine room.

As in the case with the piston L' and the ports I' and H', should there be leakage in the piping system communicating with the space S', the diaphragms R' R' will be distended slightly, thus holding the valve U' open sufficiently to make up the leakage and maintain constant pressure. Conversely, it is evident that if the pressure in the space J' should increase above that predetermined for a given position of the piston F', the piston L' will move to the left, and open communication between the space J' and the inside of the piston L', thus exhausting air from the space J' to atmosphere through the port M'. This condition also arises when operating lever D' is moved towards the off or central position, which permits the movement of the valve F' to the right. In the latter case the pressure in the space Q' will be decreased and become less than the pressure in the spaces S' S', causing the diaphragms R' R' to collapse and open the valve T' to atmosphere until the pressure in the spaces S' S' is decreased to that in the space Q'.

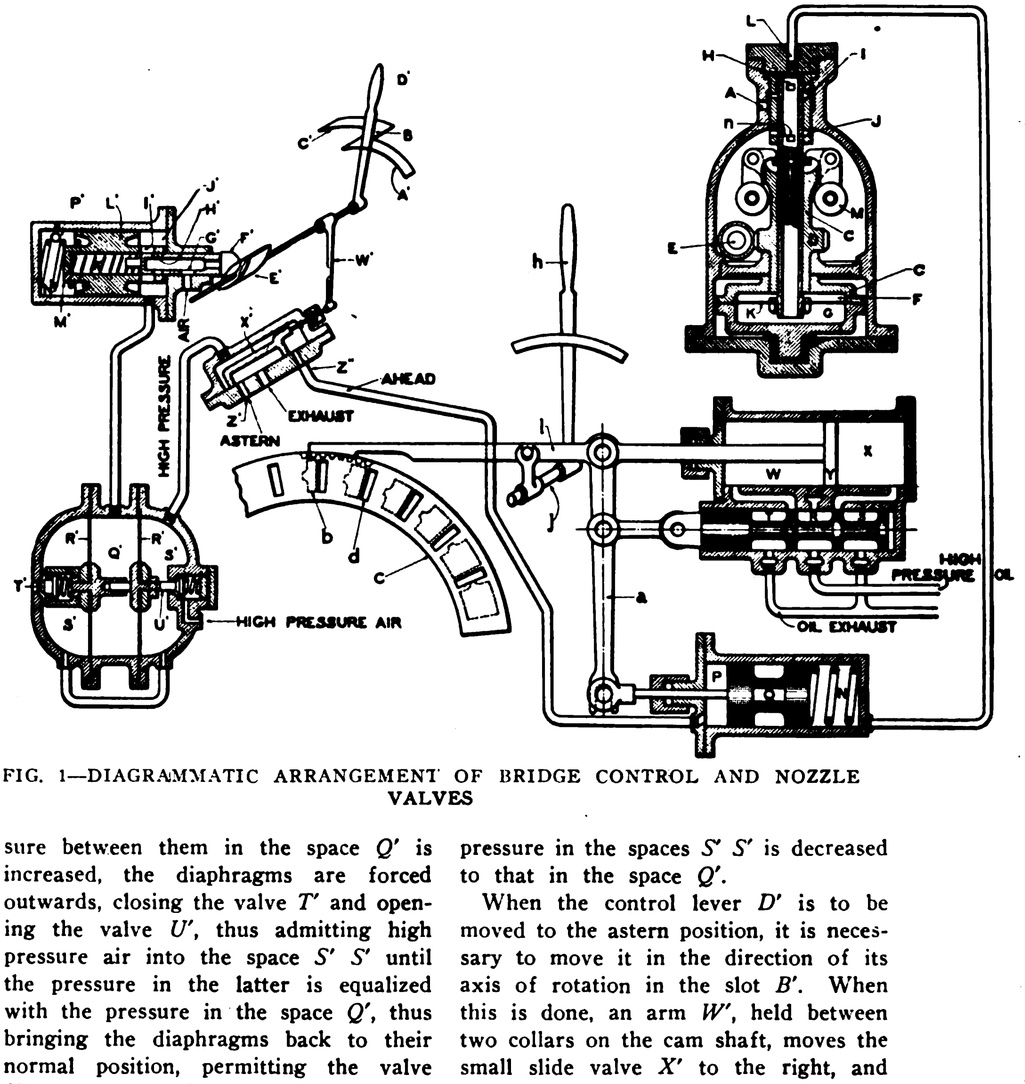


FIG. 1—DIAGRAMMATIC ARRANGEMENT OF BRIDGE CONTROL AND NOZZLE VALVES

When the control lever D' is to be moved to the astern position, it is necessary to move it in the direction of its axis of rotation in the slot B'. When this is done, an arm W', held between two collars on the cam shaft, moves the small slide valve X' to the right, and bridges the pipe Z' to the astern air relay cylinder into communication with space S', and the pipe Z'' into communication with the atmospheric exhaust.

From the above it will be seen that it is impossible for the operator to become confused and accidentally move the control lever in the wrong direction.

or try to put it in both the ahead and astern position at the same time, as it is necessary to move the controlling lever sideways before it can be moved from one position to the other.

The governor, which controls the speed of rotation of the turbine shaft, is shown on the right of the diagrammatic sketch, Fig. 1. As will be seen, it is of the common fly-ball type, and is driven through the turbine shaft by a worm *E* and wheel *D*. The only movable part of the governor is the hollow spindle *B*, having the ports *N* and *H* in it. The movement of the spindle *B* is restricted by a diaphragm *K* to which it is attached. The upper side of the diaphragm is open to atmosphere, and the space below *G* is filled with oil.

High pressure oil at about 65 pounds gauge per square inch is admitted to the revolving spindle *B* through the ports *A*.

The Governor

When the governor spindle is revolved by the turbine shaft, the balls *M M* are thrown outward by centrifugal force, thus pulling the spindle *B* downward against the resistance of the diaphragm *K*, opening communication through the port *H* in the spindle, and *I* in the upper spindle bushing, to the space *G*, the latter communicating through a port *L* to a pipe connected to the space *N* of the air cylinder relay.

As the pressure in the space *G*, below the diaphragm *K*, increases, it resists the

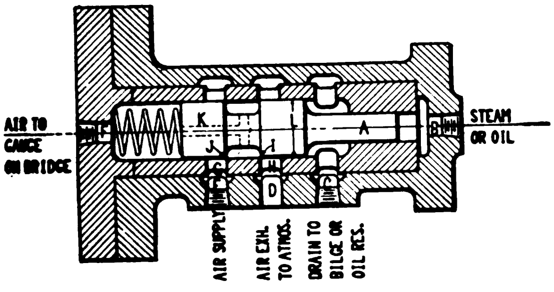


FIG. 2

downward thrust of the spindle *B*, due to the centrifugal action on the governor weights until the upward pressure on the diaphragm exactly balances the downward thrust of the spindle, thus permitting the upward movement of the spindle *B* by the elasticity of the diaphragm *K* until the communication through the ports *H* and *I* is cut off. Thus it is evident that for any given number of revolutions of the governor spindle, there must be a constant fixed pressure of equilibrium in the space *G* below the diaphragm. Should the pressure in the space *G* exceed that corresponding to the speed of rotation of the governor at any instant, the spindle *B* will be forced upward, thus opening communication between the space *G* and the atmosphere through the ports *N* in the governor spindle body.

In the center part of the diagrammatic sketch is shown the air relay cylinder, relay valve and operating cylinder, which controls the opening and closing of the nozzles of the turbine according to the speed of rotation desired. Referring to this part of the illustration, and starting with the turbine at rest, the piston *Y*, which opens and closes the nozzle valves, is at the farthest end of its travel to the right, and all the turbine nozzles are closed. Now when air from the bridge control valve is admitted to the space *P*. to the left of the air operating cylinder. the piston *Q* will be forced to the right against the resistance of a small spring, thus carrying the relay plunger *O* with it. The movement of the latter establishes communication between the space *R*, supplied with high pressure oil. and the space *X*, to the right of the piston *Y*, and the space *W*, to the left of the piston *Y*, is brought into communication with the space *T*, and thereby with the oil return to the reservoir. which is open to atmosphere. Thus the piston *Y*, will be forced to the left by the oil pressure and through a rack engaging with the gear cut in the periphery of the nozzle valve, will rotate the latter and open high pressure nozzles, thus admitting steam to the turbine. As there is nothing to resist the motion of the piston *Y*, nozzles in excess of those necessary to give the desired speed, are opened instantaneously and thus the turbine begins to speed up very rapidly. Now, however, as the turbine gains speed and the governor revolves, the governor spindle *B* is forced down and high pressure oil is admitted through the ports *H* and *I* and through the passage *L* to the space *N* to the right of the piston *Q*, thus tending to push it to the left against the air pressure in the space *P*. As the piston *Q* moves to the left, it carries the relay plunger *O* with it, and when the oil pressure in the space *N* balances the air pressure in the space *P*, or in other words, the space *J'* in the bridge control valve, the piston *Q* will take a fixed position, and the piston *Y* will take up a position such that the ports communicating with *W* and *X* are both closed, thus maintaining a constant speed of revolution.

Exceed the Speed

Should the turbine tend to exceed the speed fixed by the air pressure in the space *P*, the piston *Q* would move to the left and bring the space *X* into communication with the space *S*, connected to the oil exhaust, and the space *W* would be brought into communication with the space *R*, supplied with high pressure oil. This would cause the piston *Y* to move to the right until sufficient nozzles had been shut off to reduce the speed, until the oil pressure in the space *N* was again brought into equilibrium with the air pressure in the space *P*.

The principal features in which the above arrangement of the controlling system differs from that installed originally on the "Neptune," is in the substitution of a rectilinear operating piston and a semi-circular slide valve for controlling the steam to the nozzles in place of the rotary valves and wing pistons used for moving the valve previously employed. Also far greater sensitiveness of the speed control and air pressure control have been obtained by the substitution of the diaphgrams *R' R'* in the air relay, and the diaphragm *K* in the governor in place of the pistons used for this purpose in the first "Neptune" installation.

Although up to date no difficulty has been experienced with sticking of these pistons, experiments made in the shops at East Pittsburgh indicate that such might arise, and this, as well as leakage, was the chief reason for the changes made, although the greater sensitiveness obtained by the use of diaphragms instead of pistons was also partly the object.

Bridge Operating Stand

The bridge operating stand which supports the bridge control valves is shown in Fig 3, from which it will be seen that there is a rotary slide valve on top of the stand between the port and starboard control valves. This latter valve is not shown in the diagrammatic sketch previously described, and is not shown in detail because of the difficulty of showing the various ports in it. Its function, however, is to permit operating both turbines, either ahead or astern, by either the port or starboard control valve, or to cut out both the starboard and port control valves. In addition to these functions which this valve performs on the bridge control stand, the similar valve on the control stand in the engine room has a position for cutting out the bridge stand and other operating stands in other portions of the ship; "*B*" thus when the control system on the bridge is connected, all control stands excepting that in the engine room, are made inactive, while if the stand in the engine room is being used, all other stands (including the one on the bridge) are disconnected. This arrangement avoids interference, permits rapid changes from one station to another, but always leaves the engine room stand operative in case of an emergency.

Ordinarily, except when maneuvering, the bridge stand is always connected up so that both turbines are controlled by moving either the port or starboard con-

trol levers, which simplifies the operation and permits controlling both turbines if either the port or starboard operating valves should for any reason become temporarily disarranged.

In addition to the standard screw down valves on the ahead and astern turbines, each turbine is provided with a hand operating device, by means of which a nozzle valve can be moved by hand, if necessary or desirable.

This is accomplished by the lever *h* as shown in the diagrammatic sketch Fig. 1. The lever is pivoted on the shaft *j* and has a lever engaging with the crosshead on the valve operating piston rod *L*. The latter lever is fitted with a latch so that it can be quickly connected or disconnected when not in use.

Control of Turbines

As previously pointed out, there may be a number of operating stations from which the turbines can be controlled when this is desirable, as for instance, there might be considerable advantage in the case of battleships in having the turbines controlled from the central station as well as from the bridge and starting platform.

After the officers have once become accustomed to using the bridge control, they will no longer use the engine room telegraph and will not feel as a man would, had he only the steering wheel of an automobile under his control and compelled to rely upon an engineer to control the speed and the direction of motion independently. As far as reliability is concerned, this has been absolutely proven by the experience on the "Neptune."

The only difference between the diagrammatic sketch and the actual valve gear is that in the latter the various parts have been placed one within the other in order to make the valve more compact.

In order that the officer on the bridge or navigator can see that the turbines are operating as desired, and also to show that the control system in in operating condition, gages are provided which show the steam pressure in the boilers, the air pressure in the control system, the air pressure in the pipe lines *Z' Z"* as well as the pressure in the oil supply system, and the pressure of the oil under the pistons of the floating frame on the reduction gears.

As it would be frequently necessary to have the piping communicating from the engine room to the bridge in exposed places where it would be liable to freeze and because of the difficulty of allowing for the hydrostatic head in the pipe between the bridge and the engine room in the case of liquids, the steam and oil pressures are indicated on the bridge by means of compressed air and a small relay valve, such as illustrated in Feg. 2. As the steam pressure or oil pressure to be indicated on the bridge may exceed the air pressure available, the former are reduced in some ratio, such as 2 to 1 or 3 to 1, as required.

In Fig. 2 the orifice *B* is connected to the steam or oil line, and the pressure desired is indicated on the bridge by the air pressure in the pipe connection to *F* which communicates with the gage on the bridge. The operating element of the relay consists of the plunger *L A*, having *L* and *A* the same diameter or *A* a smaller diameter than *L* for relaying oil or steam pressures. The plunger *L A* is fitted in a bushing, having ports *G* and *H*, port *G* communicating with the high pressure air supply and port *H* communicating with atmosphere. A drain *C* is also provided, which may either drain to the bilge or to the oil reservoir when oil pressure is being relayed.

Normally, when not being used, the small spring pushes the plunger *L A* to the right, and the gage on the bridge is then connected to atmosphere through the ports *K* and *H*. When steam or oil under pressure is admitted at *B*, the plunger *L A* is forced to the left against the resistance of the spring, and the edge *J* of the plunger *L A* moves over the port *G* and admits high pressure air through the port *K* to the gage on the bridge, the pressure in the space to the left of the plunger *L A* increases until the pressure times the area of the left-hand portion of the plunger *L A*, equals the pressure times the area on the right hand portion of the plunger *L A*, thus if the diameter of plunger *L* is twice the diameter *A*, the area of the large end of the plunger will be four times that of the small end, and the actual pressure maintained on the left-hand side of the plunger will be one-fourth of that maintained on the right-hand side of the plunger, thus 200 lbs. gage steam pressure would be indicated on the bridge by 50 lbs. of air pressure. The oil pressures are transmitted to the bridge in the same way.

Relay Device

This relay device has been found very sensitive and accurate, and so far has never given any trouble in the installation on the "Neptune."

As was pointed out in describing the operation of the controlling system, there is a fixed pressure (for any given number of revolutions per minute of the turbine shaft) in the spaces *Q'* and *S' S'* as well as under the diaphragm *K* in the governor spindle and the space *N* to the right of the air operating cylinder. Consequently, instead of graduating the gage recording the air pressure in the space *S'* in pounds, this scale may conveniently be graduated to read revolutions per minute, so that those in charge on the bridge can see every instant exactly the number of revolutions which the propellers are making.

Another novel feature of the new control apparatus used on the U. S. "Neptune" is a set of speed recording instruments. As previously mentioned, for any given turbine speed there will be a definite oil pressure under the diaphragm *K* of the governor, and consequently this pressure can be used to indicate the speed of the turbine and propeller.

Pressure gages of the recording type may be used, showing the speed, direction of rotation and period of operation of each turbine under any given conditions. These records furnish an accurate log which is indisputable in case of a controversy regarding the speed or manner in which the turbines were operated. These cards can be graduated to read revolutions or knots, as desired.

Lundin Life Boat

Official approval of the Lundin housed life boats and the Lundin power life boat has been received by the builders, the Welin Marine Equipment Co., of Long Island City, from the United States Steamboat Inspection Service.

This approval is based on the tests conducted at the company's dock in the East River March 13 and out at sea on the following day. Sixty-seven men, fifty inside and seventeen more standing on one side, outside, tested the floatation and stability of the 30 x 10 ft. power boat and sixty-one men were lowered from a pair of Welin davits mounted on the dock into the water in a 28 ft. Lundin decked life boat. Eight members of the Steamboat Inspection Service besides Supervising Inspector General Geo. Uhler witnessing the test, and on the following day watched the boats maneuver out at sea from an ocean tug. So satisfactory were all these tests that official approval has been given for their use on steamships.

The two large twin screw passenger and freight steamships building at Cramps, Philadelphia, will have the paneling of passageways and doors of Nevasplit, furnished by the Keyes Products Co., 71 West Twenty-third street, New York.

The Bowers Southern Dredging Co., Galveston, Texas, was lowest bidder for constructing the dredges Sam Houston and San Jacinto for service in Lt. Col. Riche's department.

Motor Life for Atlantic Liner

An interesting novelty has been introduced by the Allan Line of steamships on board its two new liners Alsatian and Calgarian, in the form of motor lifeboats. These were built by McLaren Bros., of Dumbarton, Scotland, and are fitted with Marconi wireless telegraph apparatus. The launches, one of which

MOTOR LIFEBOAT FOR ATLANTIC LINER

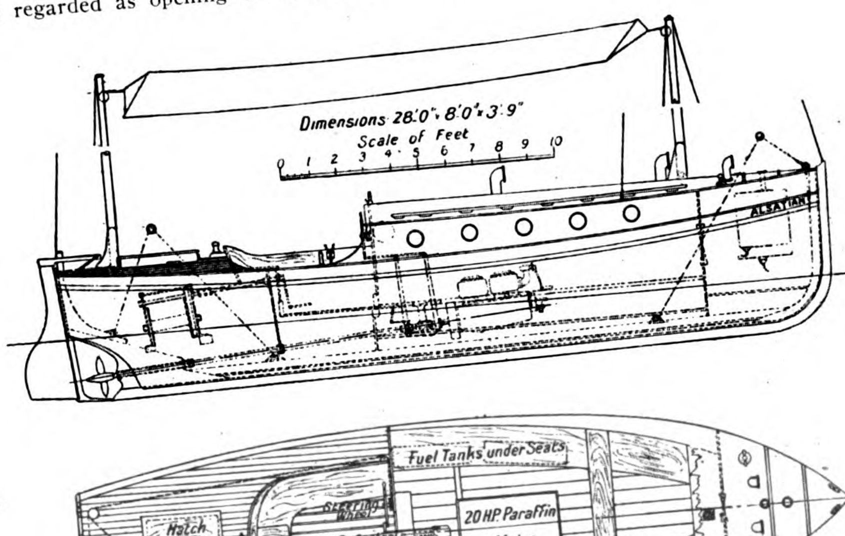
has been supplied to each ship, are carried on davits at the aft end of the vessel, and are always kept in readiness for immediate use.

The lifeboats have been primarily designed with the intention of making them absolutely unsinkable in heavy weather. With this object in view, they have been decked entirely fore and aft, with a small watertight cockpit aft of midships to accommodate the steersman and afford access to the cabin, which is arranged to seat twenty-eight persons. The hull is constructed of mahogany and oak of extra heavy scantlings. A special feature of the cockpit is the ample self-draining arrangement, which allows about 20 cubic feet of water to pass out of the cockpit into the sea in three seconds, so that the cockpit should prove no source of danger in a heavy sea. At the aft end under a small hatch is fitted a winch on which about 500 yards of wire rope are coiled for use when towing other lifeboats, for rescue work, etc. The winch can be operated by hand from the cockpit, or it may be coupled up to and driven by the engine under the control of the engine clutch. Hand and power bilge pumps are fitted for draining the various compartments of the boat, should this at any time be found necessary.

Substantial chain lifting slings have been fitted fore and aft. Within an airtight compartment at the fore end is the main fuel tank, with a capacity to allow of running twenty hours without replenishing. In addition to this, in each bilge are fitted fuel tanks which in turn replenish the main fuel tank by means of a pump connection. Thus, the boats have a total capacity for running at full speed for forty hours. A watertight bulkhead is fitted between the cabin and the after part of the boat.

The power plant consists in one boat of a Gardner paraffin engine of 20 horsepower, driving a MacLaren patented reversible propeller through the latter firm's special form of marine clutch. In the other boat a Gleniffer paraffin motor is installed driving a similar propeller gear. A small dynamo driven by the engine supplies current for the wireless telegraph apparatus. An arrangement is also provided for driving the dynamo by hand should the engine power not be available. Two specially long masts are provided, on which two 20-ft. aerials may be hung at a height of 25 ft. from the sea level, giving a range of communication of about thirty miles radius. Messages can also be transmitted over a two-mile range by the submarine signalling apparatus fitted on board. Under pressure from the engine a small compressed air tank supplies blast to the whistle.

The boats are thus very complete, and are regarded as opening a new area in the development of equipment for the saving of life at sea. There is little doubt, it is held, that many ocean-going liners will soon be provided with power lifeboats of this type.



SHIP'S MOTOR LIFEBOAT

Three thousand "Boddy" life-saving jackets have been supplied to the Cunard Steamship Co. for use in the great liner Aquitania.

The Late Alfred Noble

American engineers will be gratified to read the tribute paid to the late Alfred Noble by *Engineering*, of London. Few men have been identified with so many great engineering undertakings as Mr. Noble, and his work was watched with interest throughout the whole engineering world:

We regret to have to record the death, which occurred on Sunday, the 19th ult., at St. Luke's Hospital, New York, of Mr. Alfred Noble, the well-known American civil engineer.

Mr. Noble was born on Aug. 7, 1844, at Livania, Wayne County, Michigan, where his parents resided on a farm. His grandfather served in the war of 1812, and his ancestors took part in the revolutionary war. He received his early education in the district school of his native place, and worked on his father's farm during his spare time. In 1862, when only eighteen years of age, Mr. Noble enlisted in the 26th Michigan Volunteer Infantry Regiment, and took part in the Civil War. From that date, until the year 1865, he served in the army of the Potomac through the whole of the Civil War, fortunately without being wounded; he was mustered out of the service in June, 1865, with the rank of sergeant.

Immediately on leaving the army, Mr. Noble prepared to enter the University of Michigan; in 1867 he became a sophomore, graduating in 1870 with the degree of civil engineer.

He commenced his life as an engineer in 1868, and from that year to 1870 he acted as an assistant engineer on river and harbor works on the Great Lakes. From 1870 to 1872 he had charge of improvements on the St.

Mary's Falls canal and St. Mary's river, during which time the first great masonry lock at the Sault, then by far the largest canal lock in the world, was built. When this work was completed, Mr. Noble became resident engineer on the construction of an important bridge over the Red river at Shreveport, La. From 1883 to 1886 he was general assistant engineer to the Northern Pacific Railroad. In the year 1886 to 1887 he was resident engineer on the construction of the Washington bridge over the Harlem river, which at the time was the largest arch bridge in existence. For the seven years following Mr. Noble was resident engineer on the construction of several very large and important bridges over the Mississippi at Memphis and Alton; over the Missouri, at Bellfonten, Leavenworth; and over the Ohio, at Cairo. In 1895 he was appointed by President Cleveland a member of the Nicaragua canal board, which visited central America and examined the route proposed for a Nicaraguan canal and also the Panama canal; the board completed its work on Nov. 1, 1895.

In that same year—1895—Mr. Noble received the degree of LL. D. from his Alma Mater; he received a similar degree from the University of Wisconsin in 1904.

Mr. Noble was appointed by President McKinley in June, 1899, a member of the Isthmian canal commission. This commission had charge of the selection of the best canal route across the isthmus; the Panama canal has been constructed substantially on the lines given in the report issued by it. While on this commission, Mr. Noble, together with his colleagues, visited Europe to examine the existing canals there, and to look into the data which the French Panama Canal Co. had in Paris; they also made several trips to Central America to consider more fully the various Central American canal routes.

Consulting Engineer Panama Canal

In 1905 Mr. Noble was appointed by President Roosevelt a member of the International Board of Engineers to recommend whether the Panama canal should be constructed as a sea-level or as a lock canal. This board consisted of thirteen members, of whom five were nominated by foreign governors, and Mr. Noble was one of the minority of five Americans who recommended a lock canal. The views of the latter were adopted by the government and the canal has been built in accordance with their recommendations.

In March, 1907, Mr. Noble was one of the three appointed by President Roosevelt to visit the Panama canal, with the object of investigating the conditions regarding the foundations of some of the principal structures. This duty was completed in a few weeks. He was obliged to decline a similar appointment two years later. From the very inception of the plan by the United States to build an Isthmian canal, and from the commencement of the preliminary investigations and surveys to the adoption of the final plan, and the commencing of the actual construction of the canal, Mr. Noble was continuously identified with the project, and deserves as much credit for the solution of the engineering problems as anyone who has been connected with this great work.

Deep Waterways Commission

To revert to earlier work of his in other spheres, we may state that in July, 1897, Mr. Noble was appointed by President McKinley a member of the United States Board of Engineers on Deep Waterways, which carried out surveys and drew up estimates for a ship canal to be built from the Great Lakes to deep water in the Hudson river. In Nov., 1901, the city authorities of Galveston, Texas, appointed him, in conjunction with Mr. Henry C. Ripley and General Robert, the three forming a board of engineers, to devise a plan for protecting the city and suburbs from inundation. They recommended the building of a solid concrete wall over three miles long and 17 ft. in height above mean low water, the raising of the city grade, and the making of an embankment adjacent to the wall. The whole of this work was estimated to cost about three and a half million dollars, and the plan recommended by the board has since been carried into effect. From 1902 to 1909 Mr. Noble was chief engineer of the East river division of the New York extension of the Pennsylvania railroad, and had entire charge of this most difficult piece of work, involving, as it did, a very accurate survey across Manhattan, and the construction of the foundations of the Pennsylvania station, of land tunnels, and of the East river tunnels, all of which included difficult and most troublesome work.

Since 1909 Mr. Noble had engaged in general consulting engineering practice, his firm's name being Noble & Woodard. Probably the most important work he dealt with in his capacity was in relation to the dry docks built for the United States government near Honolulu. He was also for a time consulting engineer to the Quebec Bridge board, consulting engineer for the Board of Water Supply, New York City, and for the Pubilc Service Commission of the First District of the State of New York.

Mr. Noble was past-president of the Western Society of Engineers, of the American Society of Civil Engineers, and of the American Institute of Consulting Engineers. In 1910 he was awarded the John Fritz medal for "notable achievements as a civil engineer." In 1911 he was elected an honorary member of our own Institution of Civil Engineers, a distinction which he most thoroughly merited. In 1912 he received the Elliott-Cresson medal of the Franklin Institute "in recognition of his distinguished achievements in the field of civil engineering."

Mr. Noble married, on May 31, 1871, Miss Georgia Speechley, of Ann Arbor, Michigan. They have one son, Mr. Frederic Charles Noble, a graduate in engineering of Ann Arbor University, 1894, who is now following his engineering profession in New York City.

The subject of our memoir was deeply interested in all questions which concerned the engineering profession, and during the last few years of his life he took a most active part in the organization and upbuilding of the American Institute of Consulting Engineers. He rarely missed a meeting of the institute or of its council. His unfailing good humor, his kindliness and sweetness of disposition, his sound common sense and good judgment, his youthful mentality, his quick and sure perception, and his modesty, invariably impressed his colleagues with whom he worked on many committees.

A Rare Character

He possessed a combination of strength, gentleness, tact and discernment rarely met with. He was universally respected by all who had any business dealings with him. The plain workman, the man with the pick and shovel, the contractor, the technical engineer, or the president of a great corporation, all appreciated the nobility, simplicity and honesty of his character. His personality was such as to evoke the faithful and enthusiastic loyalty of his subordinates, and the deep, strong and lasting affection of all those who were honored with his friendship. His loss will be deeply felt, not only by the engineering profession, of which he was a most distinguished member, but by every one who had the good fortune to know him.

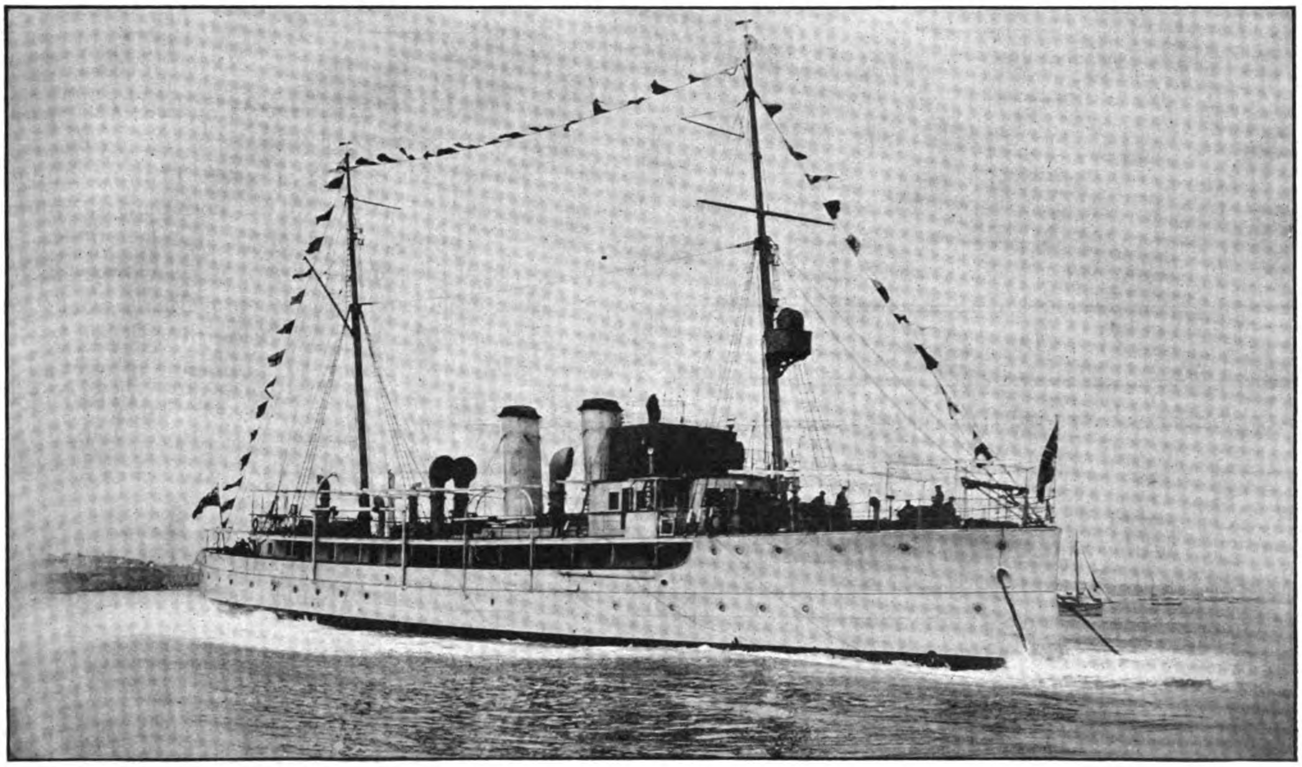
The steamer L. C. Waldo, which stranded on Manitou island, Lake Superior, in the gale last Nov., has been released by the wrecker Favorite and taken to Portage. It is the intention to bring her to a Lake Erie port for examination. The underwriters have settled for the Waldo as a constructive total loss.

Canadian Customs Cruiser

The revenue cruiser Margaret, built to the order of the Canadian customs department for patrol service on the Atlantic coast, by John I. Thornycroft & Co., Ltd., of Southampton, England, illustrated in the photograph on this page, is of the following principal dimensions:

Principal dimentions.	
Length overall	200 ft.
Length between perpendicualrs,	185 ft.
Breadth, molded,	32 ft.
Depth, molded,	16 ft.

The draft is limited to 10 ft. 6 in. when carrying a load of 175 tons. A ram stem and cruiser stern add to the appearance of the boat, which indeed is a fine-looking craft. A double bottom is fitted under the engines and the hold forward and the hull is stiffened to resist ice, the propeller shafting being also housed in the hull for the whole of its length to prevent damage by ice. Watertight bulkheads divide the various compart ments, and the bunkers are watertight also. Sliding watertight doors of the quick-closing type are fitted to be worked from the upper deck. The bunkers have a capacity of 200 tons, giving a radius of action of nearly 2,000 miles at full speed, and about 4,000 miles at economical speed. The vessel is rigged as a fore and aft schooner, and has an outfit of boats consisting of 30-ft. Thornycroft motor launch, a 26-ft. lifeboat, 22-ft. captain's cutter and a 16-ft. dinghy. For armament the vessel carries, mounted on the forecastle deck, two 6-pdr. quick-firing guns of the Vickers latest improved type, with telescopic sights. She is fitted in a most up-to-date manner, carries a wireless telegraphy outfit, is electrically lighted, and has a 24-in. projector searchlight of 25,000 c. p. fitted in the crow's nest on the foremast. A refrigerating plant is installed, and a complete cold store below contains separate rooms for meat, vegetables and other provisions. The vessel is heated by steam throughout. The propelling machinery consists of two sets of vertical reciprocating engines running at 180 r. p. m., and having a combined i. h. p. of 2,000. The low pressure cylinders exhaust each into a separate condenser to which the circulating water is delivered by independent centrifugal pumps. A 15-ton evaporator, by Messrs. Weir, is installed, and the main and auxiliary feed pumps are also of Weir's make. Steam is supplied by two watertube boilers of the watertube type.



CANADIAN CUSTOM CRUISER MARGARET

New Dry Dock at Sault Ste. Marie

The by-law which was passed recently by the rate-payers of Sault Ste. Marie, Ont., to subsidize the building of a dry dock there, provides for a bonus of $20,000 a year for 20 years, for a fixed assessment on the property for school taxes of $750,000 for 20 years, for exemption from general taxes for five years, and for a fixed assessment of $500,000 for general taxes for 15 years.

The agreement provides that work shall be commenced by April 1, on the laying out and construction of the dry dock and shipbuilding plant, and the equipment is to be completed to the satisfaction of the Dominion public works department so as to earn the annual government subsidy of 3 per cent for 20 years on an expenditure of not less than $1,338,026.76, the whole to be completed and equipped ready for operation by April 1, 1916.

The dry dock is to be built of concrete, and is to be not less than the following dimensions:

Clear length inside gate sill	650 ft.
Clear width at gate sill	65 ft.
Width at coping level	90 ft.
Width in dock chamber at coping level	106 ft. 8 ins.
Width at sill level	93 ft. 4 ins.
Width at bottom	80 ft.
Depth on sill below ordinary low water level of St. Mary River.........	18 ft. 6 ins.

Payments of the corporation subsidy will be made annually on Nov. 1, the first of such payments being due on Nov. 1, 1916, provided the plant is completed and ready for operation at the time stated. The site for the plant comprises a water lot of about 5 5-10 acres.

The agreement with the city was made with F. H. Clergue, and the Lake Superior Dry Dock and Construction Co., Ltd., has been formed for the purpose of carrying on the work.

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June, 1914

Lake Trade

Lake trade has certainly been in the doldrums during the past month, but there is now noted a slight improvement in affairs, and inspires the hope that things will presently get better. What a blessing hope is with its eternal fire. No company that man keeps is so constant and unchanging. His fortune may disappear, his wife elope, his friends pass him by, even his dog may be stolen, but hope abideth ever. Enough, however, of these reflections. What is more to the point is that a little wild tonnage has been chartered in the ore trade, and that more is expected to be chartered in a few days, even though the shippers have not as yet put all their own vessels in commission. Ore sales have been slow but are now gradually picking up. What with the drift of the season so far furnacemen will have to make up their minds shortly as to their requirements or they may find themselves unable to obtain delivery. The movement to June 1 will be light, and the June movement will probably not be heavy, but should there be a revival in July the late summer and fall months will be brisk ones on the lakes. One of the remarkable things about the iron business is that no one is wise enough to say what it will be three months hence. It has an astounding faculty for recovery. We will know a little more about the matter when we get the May figures of pig iron production. If the furnaces continue to produce iron the way they did in March and April, then some ore will have to come down these lakes, and the time to bring it down will be very short.

The ore trade is, of course, the dominant trade of the lakes, but the coal trade is getting to be a healthy second. Coal has had a bad start this season, and the movement so far has been light, but it is a foregone conclusion that the Northwest will require its usual quota of coal. Cargo and fuel coal reached the respectable total of 33,000,000 tons last season, and while it will probably be less this year, the block will still represent a good round sum. And there's the grain trade, growing like the proverbial green bay tree. It isn't prudent to be a pessimist on lake trade. One may be deceived to one's sorrow.

Campaign for Sanitation

During the past four years the leading industries of the country have paid a great deal of attention to the question of safety to the end that the number of personal injury cases might be lessened. The railways have developed this safety campaign to a remarkable extent. Since the movement was started four years ago, the Chicago & Northwestern Railway has reduced the number of accidents nearly 30 per cent. During the past four years 10,000 fewer persons were injured on this railway system than in the preceding four years—a very real and gratifying achievement.

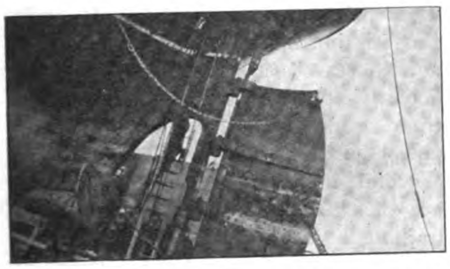
On the Great Lakes the Lake Carriers' Association has conducted a systematic campaign for the elimination of the avoidable accident by distinctly marking dangerous places and by appointing safety committees from among the crew on each ship. In addition, the association has this spring begun a campaign on sanitation to promote the physical well-being of the men. A man is obviously not competent to do a day's work unless he is in good health. The initial steps in the campaign have to do with the care and preparation of food supplies. Every dealer on the whole chain of lakes supplying meats, milk, groceries and ice to the boats has received a circular from the Welfare Plan Committee of the Lake Carriers' Association outlining certain simple rules to be observed in the care of food stuffs. Meats are to be kept in the refrigerator away from flies and not exposed to handling by prospective customers. Milk must be pure and cannot be transferred from one can to another until the cans have been thoroughly sterilized, and ice must under no circumstances come in contact with food. Manufactured ice is preferred because being made from distilled water it is chemically pure, while natural ice may be of doubtful purity. The observance of these rules will go a long ways towards the elimination of typhoid fever cases, because typhoid is a disease which is communicated to the system through food and drink.

Steamer Frasch's Jury Rudder

The rudder post of the steamer Herman Frasch, was carried away suddenly while the steamer was within fifteen miles of Diamond Shoal (Hatteras). The vessel was on a lee shore with a strong breeze and rough sea, but by rigging a jury rudder and with some help from a revenue cutter, Capt. Arthur N. McGray succeeded in work-

HERMAN FRASCH'S JURY RUDDER

ing her into smooth water, tipped the ship by the head with water ballast, though she was loaded with crude brimstone in bulk, which is a heavy cargo, and succeeded in getting the part of the rudder which was uninjured far enough out of water to enable the engineers to drill holes through the rud-



HERMAN FRASCH'S JURY RUDDER

der plate, into which the steering chains were shackled. The chains were then led through outriggers 15 ft. overside, and then by tackle to the poop deck winches. Under this rig the steamer was enabled to make the remaining 260 miles to New York without assistance, and at a speed of 8½ knots.

Poe Reef Light and Fog Signal

President Livingstone, of the Lake Carriers' Association, has sent the following circular to the masters of vessels enrolled in the association:

"Mr. E. L. Woodruff, inspector of the eleventh lighthouse district, in submitting his report to the commissioner of lighthouses regarding aids to navigation in his district which were recommended by our committee on aids to navigation, makes the following notation with special reference to the light and fog signal asked for Poe Reef, easterly entrance to the Straits of Mackinac, Lake Huron, Mich:

"'A light and fog signal in this locality would be valuable aid to navigation, but a preferable site, in my opinion, would be 112° true (SE by E 13/16 E Mag.) 2⅜ miles from Poe Reef light vessel station in 20 ft. of water. This, it is believed, would supersede the necessity of establishing a light at Nine Mile Point, already recommended, as also the maintenance of the Poe Reef light vessel. A trial of this arrangement of aids might be made by changing the position of the vessel to a point in about 5 fathoms of water near this locality, as above described, and establishing a gas buoy on the present site of Poe Reef vessel.'

"The commissioner, before acting upon this recommendation, has requested that the views of maritime interests as to trial arrangement of aids as outlined above be obtained from masters and a further report submitted.

"Masters are therefore requested to send their opinion of this recommendation directly to me at 2217 Dime Savings Bank Building Detroit, Mich.

"Prompt attention to this request will be appreciated."

April Ore Shipments

During April the mines sent forward 269,686 tons of ore, compared with 866,387 tons during April. Following are the shipments by ports:

Port.	April, 1913.	April, 1914.
Escanaba	217,029	110,729
Marquette	37,494	....
Ashland	53,481	40,838
Superior	252 875	62,338
Duluth	160,372	......
Two Harbors	145,136	55,781
	866,387	269,686
1914 decrease		596,701

The government engineer, Norfolk, Va., received the following bids for building two wooden barges for service at Norfolk: Sanford & Brooks Co., Baltimore, Md., $11,652.66; McLean Contracting Co., Baltimore, Md., $11,250; C. H. Denmead & Son, West Point, Va., $11,300; Colonna Marine Railway Corporation, Norfolk, Va., $9,950; Old Dominion Marine Railway Corporation, Norfolk, Va., $9.362; John H. Mathias Co., Camden, N. J.: W. E. Thomas & Co., Norfolk, Va., $8,945.26; William L. Miller, 171 Alford street, Boston, Mass., $9,115; Skinner Ship Building & Dry Dock Co., Baltimore, Md., $12,484; Smith & McCoy, Norfolk, Va., $10,500.

Ore on Dock May 1

Statistics gathered by **The Marine Review** from the various dock managers at Lake Erie ports show that the amount of ore on Lake Erie docks on May 1 of the present year was 5,920,157 gross tons, as against 5,909,829 tons in 1913, an increase of 10,328 tons.

The total rail shipments from Lake Erie ports to furnaces during the winter season (Dec. 1 to May 1) aggregate 3,341,519 tons, viz:

	Tons.
On dock Lake Erie ports, Dec. 1, 1913	9,261,676
On dock May 1, 1914	5,920,157
By rail to furnaces, winter of 1913-14	3,341,519

Adding these winter shipments to 35,747,800 tons, the amount shipped to furnaces during the navigation season of 1913, gives 39,089,319 tons as the entire consumption of ore from Lake Erie ports during the year ended May 1, 1914, as against 37,437,269 tons for the year ending May 1, 1913, as against 26,428,799 tons for the year ending May 1, 1912, as against 32,636,692 tons for the year ended May 1, 1911, as against 33,599,913 tons for the year ended May 1, 1910, as against 20,524,523 tons for the year ended May 1, 1909, as against 31,692,446 tons for the year ended May 1, 1908, as against 30,099,769 tons for the year ended May 1, 1907, as against 28,984,358 tons for the year ended May 1, 1906; 20,057,070 tons for the year ended May 1, 1905; 18,739,995 tons for the year ended May 1, 1904; 21,905,251 tons for the year ended May 1, 1903; 17,216,065 tons for the year ended May 1, 1902; 14,465,260 tons for the year ended May 1, 1901; 15,882,881 tons for the year ended May 1, 1900.

The following table gives the amount of ore on dock at the close of navigation last year and the opening this year:

Port.	May 1, 1914.	Dec. 1, 1913.
Buffalo	271,492	319,726
Erie	461,750	594,613
Conneaut	495,153	1,248,032
Ashtabula	2,187,622	3,202,807
Fairport	245,038	478,014
Cleveland	1,487,292	1,930,720
Lorain	245,057	694,704
Huron	308,478	441,541
Sandusky	2,741	2,472
Toledo	215,534	349,047
	5,920,157	9,261,676

Out of a total movement of 269,686 gross tons of ore during April, 50,544 tons went to Lake Erie ports, distributed as follows:

Port.	Gross tons.
Buffalo	38,710
Cleveland	11,834
Total	50,544

Our Commercial Dependence

By Adrian H. Boole, in *The Navy.*

If the national flag of our country is ever to appear in foreign ports, not alone as the symbol of our potential fighting strength as a nation, but as an emblem of commercial power as well, it behooves us to pause and seriously consider the methods by which our foreign rivals have outdistanced us in the race for commercial supremacy,—the controlling factor of complete industrial independence.

Delivery of Goods

How quick we all would be to condemn the policy of a large department store that should refuse to exercise control over the conveyance of purchases made for delivery to our homes, by not owning the vans and employing its own drivers to perform that important function. How long would any department store be able to successfully compete with others, if it sought to meet the elements of competition only as far as its counter sales, and then turned its sales over to a competitor to complete the transaction by effecting the physical delivery to customers? With astute employes on the wagons, scrutinizing the quality, the character, and the destination of all shipments, how long would it be before the knowledge thus gained would be availed of by the competitor, to cut into the other's trade? In the end, which house would command the business situation? And yet such a procedure, if followed, could not but be sanctioned by the present standard of business ethics.

The matter is put thus in order to drive home the fact, lamentable though it may be, that we are today in precisely the same relation to foreign merchants that a department store turning its deliveries over to a rival would be to that rival. Figuratively, we end at the counter our competition as to quality and prices for the world's trade, and then call in the vehicles of our foreign rivals to deliver, to our customers abroad, the surplus products of our energy and brains.

What is true in principle with dissociated individuals, is true in princple with nations; the difference is in degree only and not in form. The minimum of dealings between nations is many times the maximum of dealings between individuals or even larger corporations. Corrective measures in the adjustment of international problems, therefore, very often assume such huge proportions that their accomplishment is entirely beyond the pale of unaided individual effort. Even when possible, it is not to be expected that private enterprise will engage in purely Utopian achievements, unattended by immediate financial gain. Such matters should, very properly and necessarily, be dealt with by the people as a whole, through and by their government. If we must seek precedent for this doctrine, we have but to investigate the policies of other governments to find that, in the matter of foreign trade, they take the most effective measures to insure workable conditions under which individual enterprise, within their own ranks, carry out the functions essential to their own welfare.

In the case of England, of France, of Germany, and of Japan, there is insufficient land surface really to supply home food requirements, so all these people must look to the granger countries for the deficit in their food supplies. If, therefore, they must buy from abroad, they must also sell to pay for what they buy, and thus the preservation of foreign markets is vital to their existence. This brings us to consideration of the political precepts created, by these federal and imperial powers, to accomplish that end.

Territorial Dependencies

First, large territorial dependencies were acquired either by conquest or by peaceful means. These dependencies were joined to the parent countries by regular sea-communicating services under patronage of the government, and were given an ocean mail contract, an admiralty subvention, a construction bounty, or whatever might be necessary to induce citizens at home to engage in the deep sea enterprise sought and to continue it, under conditions prescribed that would secure the trades for their own people, during the unprofitable period of the maritime ventures. Later, with increased numerical and financial strength at home, this broad political maritime policy was extended to all civilized trading communities in the world, in order to insure foreign patrons after the colonies became self-sustaining. The wisdom of this is best attested by the extent to which the world's trade is now controlled by these maritime powers. Not only is the trade of the colonies secured, but today we find ourselves paying to these countries over $300,000,000 for transporting our own foreign trade.

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which last year amounted to more than $3,000,000,000. Thus have these rivals wrested from us 10 per cent of our foreign exchange for performing the task of delivering our goods, which today we cannot do ourselves. Furthermore, the same maritime policy has secured for England and Germany four-fifths of the entire foreign trade of Central and South America, which amounts to over $2,000,000,000; and this, notwithstanding the fact that both countries are at a much greater geographical disadvantage than are we for that business. Can any one, who understands, deny that it is the influence of these European subsidies, administered as they are, that has made the trade of Latin America set towards Europe?

Military Advantages

It is proper at this point, before considering the cost, to note the other military advantages that have attended the outlays incidental to pursuance of this strong maritime policy. By the payment of construction bounties or admiralty subventions, representing an insignificant part of the initial cost of construction, vessels were built to conform to military and naval requirements, for use as transports or cruisers in time of need, and these same payments made them subject to conscription in case of war. This support increased the navy's efficiency sufficiently to guarantee uninterrupted trade communications with friendly powers, in time of war. The constant peaceful employment of a large number of citizens on the seas, keeps in training a vast corps of seafaring men, always available for the navy, at no expense to the government except in time of war. Again, the home industry of ship building, for both merchant and fighting ships, is kept alive, giving employment to a large number of people. In England, Germany and Japan this industry is constantly increasing and is already a source of great productiveness. But, apart from this, these military features, it will be seen, constitute important additions to the national defense, and must, therefore, be taken into account when considering the cost imposed upon the government by subsidizing, for home benefits, private-owned merchant vessels.

According to the last annual statement of the United States commissioner of navigation, England spent last year for subsidies, ocean mail contracts and admiralty subventions, the equivalent of $7,905,764, which is equal to about 5 per cent of her naval appropriations for the same year. France paid out for mail subsidies, navigation and armament bounties, and

ship building bounties, $13,428,737. Germany, with but a small coast line to patrol, contributed $2,301,029 for mail subsidies; and Japan, $5,413,700 for mail subsidies and bounties.

During the same period the United States paid over to foreign steamship owners $1,228,032 for carrying the mails of her people. Thus are we not only paying alien steamship owners $300,000,000 for delivering our merchandise for us, but also contributing from our national treasury $1,228,032 towards perpetuating the very conditions of servitude that renders us absolutely dependent upon their good will to market our surplus products. Nor could we, in time of war, invoke the aid of these military powers that our patronage supports, if they happened to be neutral between the belligerents and ourselves.

At the present time, foreign governments are spending over $46,000,000 annually on certain types of merchant steamships, to promote the welfare of their people. It is not material how the expenditures are described; the fact, common to them all, is that strong economic reasons at home demand of each of these governments that certain types of ocean steamships, under its own flag, be kept in operation on certain routes and where they could not otherwise exist; and these governments are willing to pay enough to get them.

Difference in Cost of Operation

In this same connection it must not be overlooked that the specific amounts subscribed to individual routes, with the aid of competition, is made to conform in amounts to about the difference between cost of operation and the revenue received from the trade. The amounts paid, of course, vary, according to circumstances, in their relation to the amount of private capital invested in each particular venture, but they never exceed this difference and rarely ever reach it. To illustrate, it cost England, in 1907, £332,784 sterling to subsidize the Peninsular & Oriental Steamship Co. to maintain two sailings a week to India. This amount was equal to about 8 per cent on the company's capital stock and debentures; but it cost the P. & O. steamers £333,000 sterling for Suez canal dues, so that the subsidy did not make them whole even on this expense. Without knowing the facts, Marine Rev—Feby 4—Pomeroy the average critic would say that to pay a subsidy of 8 per cent on the working capital would be contributing an unearned increment to the special interest receiving it, whereas, nothing could be further from the truth.

If, from the standpoint of public good to their own people, the maritime policies of these foreign powers cannot be condemned, such policies should apply with equal force to our government, as we are rapidly becoming more of a manufacturing than an agricultural exporting country. Let us now consider the consistency of adopting such a policy, with other forms of our present national expenditures.

Mail Service

In 1908 the United States spent $77,943,221 for delivering the mails on land throughout the states; of this, but $43,588,012 was paid to railroads for interstate transportation; the entire balance of $34,355,209 was expended within state boundaries for rural deliveries. Post office statistics show that these rural deliveries were carried on at a great expense to the federal government. However desirable it may be to continue these rural deliveries, it cannot be denied that they are a direct contribution to special people (interests) within state limits; nor can it be claimed that as instrumentalities for the expansion of trade, they are as productive as would be the same amount expended in establishing communication with foreign markets seeking our products. Yet nothing approaching that amount has been hinted at for the latter purpose. But if it is proper for the national treasury to help pay for placing citizens, within state lines, in communication with each other, it cannot be inconsistent for it to place those same people in communication with foreign traders, when their own state has not the constitutional right to do so. To claim consistency in the former and deny it in the latter case, is absurd.

Again, the federal government each year appropriates about $1,000,000 for maintaining the state militia, in all the states; in return for this, these regiments become auxiliaries to the United States army, although they remain at home as the body-guard of their states. Is not this, in a way, an invasion of "state rights"? I am not arguing against the practice, but only claiming it justifies federal suppirt of ocean mail routes.

It is not likely that any thoughful person will dispute, in the light of what other nations have accomplished for their people by subsidizing ocean mail routes where otherwise these routes could not exist, that a great public good to all our people would result from unhampered communication, by regular fast mail steamers, with those foreign markets that will serve us both as buyers and as sellers. And if this be true, congressmen are disloyal to their constituents, if they do not enact into law the recommendation made by President Taft in his last message to subsidize within proper limits a merchant marine, for the emancipation of our industrial slavery.

Dredger for Little Current

A dipper dredge, which is being built for the C. S. Boone Dredging & Construction Co., of Toronto, for use at Little Current, Ont., was launched by M. Beatty & Sons, Ltd., at Welland, Ont., April 13. It is of steel, 100 ft. long, 40 ft. wide, 10 ft. deep at bow, and 8 ft. at stern. It is of the crane type, the crane being 40 ft. long. The dipper is of 5 cu. yds. capacity, the dipper handle is 61 ft. long, which will allow it to make 40 ft. of water. The main engine is double cylinder, 15 in. bore x 15 in. stroke, the boiler 10 ft. diameter x 12 ft. long, of the Scotch marine type. Each bow anchor or spud is operated by an independent reversible engine, 10 in. bore x 10 in. stroke, compound geared, the anchors being raised and pinned up by steel cable. The engine for handling the stern anchor is 9 x 9 compound geared. On each side of the deck forward is a 7 x 7 double cylinder, triple friction, drum engine, to be used for warping the dump scows into position.

The attempt to raise the Keystone Transportation Co.'s S. S. Keystorm, which is lying in deep water near Kingston, work on which was commenced last fall, will be resumed as soon as the weather permits. The diver who went down last year reported the vessel was in very good condition considering the time she had been under water. She was wrecked in Shippewa Bay, Oct. 26, 1912, her cargo being valued at about $300,000. The salvage has been undertaken by A. J. Lee, Westmount, Que., with the view chiefly of developing certain of his theories as to the use of compressed air for such purposes, in an extreme case, such as the Keystorm has been decided to be.

The Harlan Hollingsworth Corporation, Wilmington, Del., has been awarded a contract by Sudden & Christian, San Francisco, for a new steamer 293 ft. long, 48 ft. beam and 25½ ft. deep.

Care of Food Supplies

The welfare committee of the Lake Carriers' Association, acting under instructions from the board of directors, has sent a circular to all dealers that supply the vessels with food stuffs defining the manner in which the supplies should be handled. As considerable interest obtains in this circular, it is printed herewith:

This circular is intended to direct your attention to the world-wide campaign in behalf of safety. In such a movement sanitation must, of course, play a leading part owing to the direct bearing which it has upon the health of all of us. Absolute cleanliness is the great safeguard against the spread of disease, and it is with this thought solely in mind that the welfare committee of the Lake Carriers' Association is addressing to you this circular in the hope that it may enlist your co-operation in a work that must inevitably prove of great benefit to the whole country.

While the health of the men engaged in sailing the ships on the great lakes is probably as good as the average in other lines of employment, the opportunity is undoubtedly presented of improving the general well-being by care in the handling of food supplies and to that end a few suggestions are submitted for your consideration.

Cleanliness

The term "Cleanliness" really gives expression to the whole scope of this subject—clean stores and shops; clean attendants, both as to person and habits; clean receptacles; clean vehicles of delivery; clean methods of handling and transporting foods; will all accomplish the purpose of our desires.

Under this general head we would suggest that no dry sweeping be done in the store room or shop. More or less of the dust is merely transferred to the food.

Vermin should be eradicated.

Rats and mice should be cleaned out.

Cats, if kept, should be confined to an area where they cannot come in direct contact with food.

Proper toilet facilities for employes are a necessary requisite to a well-equipped store. Care should be taken to see that they are far enough away or so located and safeguarded as to have no influence on the supplies.

Flies

The greatest one source of contamination of food supplies comes from flies. Typhoid germs are carried more frequently by this means than any other, and danger from this source should be reduced to a minimum.

As a means to this end no waste material should be allowed to accumulate outside of the store or in its vicinity to serve as a breeding place.

The detrimental effects of flies on meat and milk is so much greater than upon other foods, that these should receive special attention and be handled in screened portions of the store.

Milk

No milk should be supplied from sources not personally known to be of unquestioned character.

A certificate from the proper health authority should be had and obtained from every producer.

Milk should be transported in cans that have been sterilized, both inside and outside.

Distributers, after assuring themselves as to the purity of the milk furnished, should see that any delivery cans to which it may be necessary to transfer it, have been thoroughly sterilized with scalding hot water, or preferably with steam.

After milk has been placed in the distributors' cans for delivery to the boat, such cans should not be exposed until transfer is made to the boat's cans.

Meats

Assuming that meats have been handled in a sanitary manner in the store, great care should be used in making delivery to the boat.

Every individual item on the meat order should be wrapped separately in clean wrapping paper.

If the quantity be large the basket or other receptacle should be lined with paper and all provided with dust proof cover securely fastened.

Baskets, receptacles and covers should be frequently cleansed.

Meat orders should be kept in refrigerators until delivery and not exposed to handling by prospective customers.

Ice

Ice in the refrigerator should not come in contact with food supplies.

Ice furnished the boats should be that obtained from good water.

Manufactured ice is preferred and should be supplied wherever possible

Sugar

Sugar should be delivered in the manufacturers' or jobbers' packages.

Fruits and Vegetables

Fruit and vegetables should not be exposed to flies and dust while on exhibition in the store and should be covered or otherwise protected during delivery.

In addition to the efforts that are being put forth by the owners and officers of the boats in this direction, the co-operation of the merchants and dealers is asked for in bringing about an entirely satisfactory condition governing food supplies furnished the boats.

We believe the time has come when that merchant who handles and furnishes supplies in the cleanest and most sanitary manner will win recognition for his efforts.

Car Ferry Ontario No. 2

An all-steel car ferry, Ontario No. 2, a sister ship to Ontario No. 1, being operated between Cobourg, Ont., and Charlotte, N. Y., by the Ontario Car Ferry Co., has been ordered from Polson Iron Works, Ltd., Toronto. The Ontario Car Ferry Co., Ltd., is a combination of Grand Trunk and Buffalo, Rochester & Pittsburgh Ry. interests, formed some years ago to handle the coal traffic originating on the latter company's lines, destined to points in Eastern Ontario, on Grand Trunk lines, the object being to eliminate the long haul around the west end of Lake Ontario. The business handled over by car ferry has increased so greatly that a second vessel is required. It will be in most particulars almost identical with the first ferry on the line, Ontario No. 1.

It is to be a twin screw car ferry of the shelter deck type, with four tracks for cars on the main deck. The main deck is to be of steel throughout, without wood covering; the shelter deck is to be of steel laid flush, with a steel deck house running throughout its greatest length and containing accommodation for passengers, officers and crew. It will have a wooden pilot house and bridge on top of the deck house forward, and a pilot house at the after end of the deck house. It will be divided into six transverse watertight bulkheads, extending from the keel to the main deck, with a longitudinal bulkhead along the center line, in three deep water ballast tanks. There will be three water tanks 13 ft. deep, two of which will be forward of the boiler room, and one aft of the engine room, steel lower deck, to be laid throughout forward and after holds and both peaks, forming the tops of the deep water ballast tanks. There will be two shaft alleys, one on each side from the engine room, extending into the stuffing box bulkhead. The boiler room will contain four single ended Scotch marine boilers placed amidships, with one firehold athwartships and one wing coal bunker on each side of the boiler room. The hull is to be bossed

out on each side to enclose the propeller shafts. There will be two steel pole spars, without masts or sails.

The ferry will have a capacity for 28 standard coal cars of 68 tons gross weight each, and 200 tons of fuel in the bunkers. The draught of the vessel will not exceed 16¼ ft. when fully loaded. It is to have a normal working speed of 13 miles an hour, to be maintained in open water, but will be capable of making 15 miles an hour to meet emergency conditions.

Length overall, 318 ft.; length between perpendiculars, 307½ ft.; beam, moulded, 54 ft.; beam, on main deck, 56 ft.; depth at center, main deck to promenade deck, 17 ft.; depth at side, main deck to promenade deck, 17 ft.; draught of water with 28 loaded freight cars and 200 tons of bunker coal, not over 16¼ ft.; camber of main and promenade decks, 9 in.; depth to promenade deck, 20½ ft.; rise of floor, 2 ft.

McArthur Jacob's Ladder

The McArthur Portable Fire Escape Co. has received the following letter from the Brown Steamship Co., of Cleveland:

"We beg to advise that the Jacob's ladder furnished the steamer Castalia during season 1913 has proven very satisfactory indeed. The master, Capt. W. L. Girardin, reports that these ladders should be installed on all the boats, as they are very efficient and much safer than the old style rope ladder."

Westinghouse Turbine and Reduction Gear Propelling Machinery for the Collier Neptune.

Steamer W. H. Donner Launched

The steamer William H. Donner, building at the Ashtabula yard of the Great Lakes Engineering Works for the Mahoning Steamship Co., M. A. Hanna & Co., Cleveland, managers, was launched on May 7, being christened by Miss Margery Russel, daughter of John R. Russel of Detroit, vice-president of the Great Lakes Engineering Works.

The Donner is building on the Isherwood system of construction and is 524 ft. over all, 54 ft. beam and 31 ft. deep, having sixteen hatches spaced 24-ft. centers with openings 12 ft. fore and aft. The new steamer is named in honor of the president of the Cambria Steel Co.

Waldo A. Avery, for many years identified with lake shipping, died at his home at Grosse Pointe Farms, Detroit, on May 9th.

Philadelphia's First Nautical Show

After a very successful week in showing the goods of some 70 firms interested in power boating, Philadelphia's first nautical show came to an end in somewhat spectacular fashion. A large fire was made in the square at Second and Walnut streets as a blaze of glory in commemoration of the first Philadelphia nautical show. At the time of the fire there was quite a breeze blowing and the burning boxes commenced to scatter over the square, which created some little excitement. The Electrene fire extinguisher, which had been on exhibition throughout the run of the show, was called into action, and a great demonstration of fire quenching was given. The hundreds who witnessed the joy blaze were surprised at the ease with which the fire was extinguished.

Although this show was held in one of the nautical instrument manufacturing company's store, it was successful beyond all expectations, and from the data gained by this exhibition of things nautical a mammoth affair will be given next fall that will compare favorably with the New York, Boston and Chicago power boat shows.

The firms exhibiting made many sales, and after the closing of the show at once formed themselves into a trade association. The body will at once make plans for the next show, securing a greater amount of business, taking agencies for out-of-town nautical articles and booming Philadelphia coastwise and foreign marine and commerce.

The John E. Hand & Sons Co. were given the thanks of the entire body of exhibitors for opening their big store as the rendezvous for Philadelphia's first nautical show.

SUMMARY OF NAVAL CONSTRUCTION.

		Per cent of completion			
		May 1, 1914.		Apr. 1, 1914	
Name of Vessel.	Contractor.	Total.	Per cent on ship.	Total.	Per cent on ship.
BATTLESHIPS					
New York	New York Navy Yard	*		99.5	99.5
Nevada	Fore River Ship Building Co	63.9	53.3	61.3	49.0
Oklahoma	New York Ship Building Co	67.2	63.9	65.3	61.7
Pennsylvania	Newport News Ship Building Co	29.1	19.9	23.7	16.4
————	New York Navy Yard	11.5	....	8.8	....
DESTROYERS					
Downes	New York Ship Building Co	95.3	95.3	95.1	95.1
O'Brien	Wm. Cramp & Sons	62.2	57.9	55.1	51.4
Nicholson	Wm. Cramp & Sons	60.5	55.8	53.5	49.3
Winslow	Wm. Cramp & Sons	54.4	49.0	49.4	44.4
McDougal	Bath Iron Works	89.3	88.6	85.4	84.3
Cushing	Fore River Ship Building Co	41.5	35.8	38.1	32.5
Ericsson	New York Ship Building Co	61.6	60.6	53.7	51.5
Tucker	Fore River Ship Building Co	9.4	....	8.3	....
Conyngham	Wm. Cramp & Sons	6.8	....	5.4	....
Porter	Wm. Cramp & Sons	6.7	....	5.2	....
Wadsworth	Bath Iron Works	17.5	....	13.9	....
Jacob Jones	New York Ship Building Co	9.8	....	9.5	....
Wainwright	New York Ship Building Co	9.8	....	9.5	....
DESTROYER TENDERS					
Melville	New York Ship Building Co	47.3	45.6	41.5	39.7
SUBMARINES					
G-4 (2)	American Laurenti Co. (Phila.)	96.4	95.5	96.4	95.5
G-2 (1)	Lake Tow Boat Co. (Bridgeport)	89.7	89.7	89.7	89.7
G-3 (1)	Lake Tow Boat Co. (Bridgeport)	81.6	81.3	81.6	81.3
K-3	Electric Boat Co. (San Francisco)	94.0	94.0	94.0	94.0
K-4	Electric Boat Co. (Seattle)	93.9	93.4	92.7	92.0
K-5	Electric Boat Co. (Quincy)	92.8	92.8	92.0	92.0
K-6	Electric Boat Co. (Quincy)	92.8	92.8	92.0	92.0
K-7	Electric Boat Co. (San Francisco)	88.9	87.6	86.2	84.9
K-8	Electric Boat Co. (San Francisco)	88.4	87.1	85.1	83.8
L-1	Electric Boat Co. (Quincy)	30.3	25.1	26.4	22.6
L-2	Electric Boat Co. (Quincy)	30.3	25.1	26.4	22.6
L-3	Electric Boat Co. (Quincy)	30.3	25.1	26.3	22.5
L-4	Electric Boat Co. (Quincy)	30.2	25.0	26.4	22.6
L-5	Lake T. B. Co. (Bridgeport)	8.1	4.6	7.4	4.2
L-6	Lake T. B. Co. (Long Beach, Cal.)	....	....	....	....
L-7	Lake T. B. Co. (Long Beach, Cal.)	....	....	....	....
M-1	Electric Boat Co. (Quincy)	20.8	16.8	17.8	13.7
L-8	Portsmouth, N. H., Navy Yard	....	....	....	....
L-9	Electric Boat Co. (Quincy)	1.9	....	....	....
L-10	Electric Boat Co. (Quincy)	1.9	....	....	....
SUBMARINE TENDERS					
Fulton	New London S. & E. B. Co. (Quincy)	62.3	59.2	53.1	48.5
Bushnell	Seattle Construction & D. D. Co	33.6	....	28.2	....
FUEL SHIPS					
Kanawha	Mare Island Navy Yard	49.0	47.6	43.8	41.1
Maumee	Mare Island Navy Yard	25.9	20.7	24.2	18.6
MISCELLANEOUS					
Sacramento	Wm. Cramp & Sons	†		92.7	92.7
Supply Ship No. 1	Boston Navy Yard	....	....	....	....
Transport No. 1	Philadelphia Navy Yard	....	....	....	....

(1) Contracts forfeited, vessels being completed New York Yard.
(2) Conditionally delivered at Philadelphia Yard Jan. 22, 1914.
*Commissioned April 15, 1914.
†Delivered April 26, 1914.

Marine Patents

Copies of any one of these patents can be obtained by sending fifteen cents in stamps to Siggers & Siggers, patent lawyers, Suite No. 11, National Union Building, Washington, D. C.:

1,095,344. Propeller for Boats. Peter J. Miller, Peck, Idaho.

1,095,461. Ship-Propulsion. Wm. L. R. Emmett, Schenectady, N. Y., assigned to General Electric Company, a corporation of New York.

1,095,485. Internal Combustion Engine. Wilson D. Craig Wright, Philadelphia, Pa., assignor of one-half to Joseph Wright, Germantown, Philadelphia, Pa.

1,095,556. Life Boat. Joseph Danko and Joseph Potoczky, Toledo, Ohio.

1,095,565. Internal Combustion Engine. Jeffrey T. Ferres, Los Angeles, Cal.

1,095,730. Rotary Internal Combustion Engine. Harold M. Jacklin, Lansing, Mich., assignor of one-half to Jeremiah Jacklin, Lansing, Mich.

1,095,732. Screw Propeller. Hugo Keitel, Dusseldorf - Oberkassel, Germany, assignor of one-half to Jeremiah Jacklin, Lansing, Mich.

1,095,831. Anchor for Submarine Mines. Giovanni Emanuele Elia, Paris, France, assignor, to Vickers, Limited, Westminster, England.

1,095,919. Ship's Buffer. John Ontko Jr., Smithfield, Pa.

1,094,429. Valve of Internal Combustion Engines. Matthew E. Dinscombe, Bristol, England.

1,094,487. Ship's Course Recording Device. Francesco Spalazzi, Rome, Italy.

1,094,554. Internal Combustion Engine. Pauline Hartman Coggin, Salem, Mass.

1,094,555. Auxiliary Air Device for Internal-Combustion Engines. Patrick H. Grace, Los Angeles, Cal.

1,094,610. Boat Fastening Means. Frederick Steinhauer, Madison, Wis.

1,094,617. Apparatus for Hoisting and Lowering Ships' Boats. Axel Welin, London, England, assignor to Welin Marine Equipment Company, a corporation, of New York.

1,094,620. Thrust-Bearing for Propeller-Shafts of Ships. Hugh Wilson, Buffalo, N. Y.

1,094,790. Rotary Internal Combustion Engine. John Royal Jahn, Riverside, Cal.

1,094,993. Cooling Internal Combustion Engines. Bertram Hopkinson, Cambridge, England.

1,095,002. Internal Combustion Engine. Simon Lake, Milford, Conn,

1,095,102. Internal Combustion Engine. Levi S. Gardner, Shreveport, La.

1,095,106. Means for Propelling Ships and the Like. Marcel Gounouilhou, Bordeaux, France.

Trials of Power Cruiser

By A. E. Luders.

Having been able to make a great deal of use of the various papers on the subject of resistance of ships and models read before this society, it has occurred to the writer that possibly similar data of a type of vessel that has not been touched upon in previous papers may prove of interest.

For this purpose the owner, Robert T. Fowler, of the 60-foot gasoline cruiser Kathmar II kindly placed this boat at my disposal and a number of runs, results of which are plotted on a curve sheet, were made. To supplement this practical information the navy department most courteously agreed to make and test a model of this boat under similar conditions of draught—their interest making this paper possible.

The results of the model experiments as made by them are given on the same sheet as the other information.

The trials were over the New York Yacht club course, 1.1 knots at Hempstead bay, where four double runs were made.

Kathmar II was launched in the spring of 1911, at which time she floated—in light cruising trim—at her designed L. W. L. The difference of displacement on the 1913 trials is accounted for by the boat being deeply laden, preparatory to starting on an extended course, by soakage and the gradual augmenting of equipment, etc., that occurs from season to season.

The bottom of this boat had not been painted for three weeks and was undoubtedly soft, though not foul. This probably explains somewhat the increase in h. p. over model experiments by an amount that indicates that the actual skin friction was practically double the theoretical.

The increased h. p. required to drive the boat with the stern cut off square at the waterline was unexpected.

The E. H. P. from trial was deduced from the thrust of the propeller (the wheel being deeply immersed, only 3 per cent of wake was assumed), and using results of Prof. Durand's investigation as a basis from which to work by the laws of comparison of similar propellers. On the basis of a propulsive co-efficient of 65 per cent the h. p. at the 10.26 knot point agrees well with the brake test of the motor.

In general, the design of Kathmar II proved very satisfactory in seaworthiness and stability, and was somewhat faster than similar boats of the same power.

*Read before Society of Naval Architects and Marine Engineers, New York.

Passing of British Warships

Several British war vessels are soon to be offered for sale, among them the protected cruiser Scylla, in which Sir Percy Scott began the movement which has resulted in making British naval gunnery the wonderfully perfect thing it is. The Scylla was one of three cruisers built in 1890 and 1891, and is of 3,400 tons displacement. She was for some time used as a drill ship for the Royal Naval Reserve and for duties in connection with the Newfoundland fisheries. The battleship Renown, another warship to be put up at auction, is chiefly remembered for the fact that she convoyed the King and Queen to India at the time of the Durbar, and prior to that was the favorite flagship of Lord Fisher. She was laid down in 1893 and has a main armament of four 10-in. and ten 6-in. guns. Her displacement is 12,350 tons. The Resolution, another battleship which will also come under the hammer, is a well known ship of the Royal Sovereign type. The Resolution proved such a trying seaboat in her early days that she was named by sailors "the rolling Resolution", and this name stuck to her until the end of her career. She was laid down in 1892, and is of 14,150 tons displacement. None of these vessels is yet 25 years old, still they are obsolete and have been ever since the dreadnought came out in 1905.

The Majestic Sold

Another famous transatlantic liner of the 90's is to pass. This time it is the White Star liner Majestic, which has been sold for $125,000, to be broken up for the metal that is in her. The Majestic and Teutonic (the latter now is in the Canadian service) were sister ships built by Harland & Wolff in 1889, and in their day were of the best vessels in the Atlantic trade. Since they were built, however, the dimensions of passenger steamers on the Atlantic have almost doubled, as they were only 568 ft. long, 57½ ft. beam and 42 ft. deep. The best speed of the Majestic was 20.4 knots.

The steamship Atlantic, building for the Emory Steamship Co. at the Fore River Shipbuilding Corporation's yard at Quincy, Mass., was launched on May 26th.

Notes on Chain Cables

At the December meeting of the Society of Naval Architects and Marine Engineers, Assistant Naval Constructor John E. Otterson read a paper on "Notes on Chain Cables", abstracted as follows:

The above paper contains brief notes as to the history of chainmaking, as to the theory of stresses in the chain link; the relative advantages of open and stud link chain, of end-welded and side-welded chain; a description of the present hand process of manufacture; the extent to which machine processes have been developed to date; and notes as to certain experimental work carried on at the navy yard, Boston, looking toward the development of a satisfactory machine process and toward the producing of chain of a more uniform and reliable quality. The paper also indicates the advantages to be gained by the proper heat treatment of the iron, and points to the necessity of more detailed and extensive study of this question.

After reading the paper, Mr. Otterson said:

History of Chain Cables

"The history of large chain cables dates back a little more than 100 years, and during that time but little advance has been made in the process of manufacture, so that the large bulk of the high grade chain cable today is made exactly in the same manner as it was made here 100 years ago, namely, by the hand process. That is largely due to the fact that the hand-made chain today is better than machine-made chains In the manufacture of cables at present we have got to the limit of hand work, we have reached the limit of the size of cable which can be economically made by hand work, and as the size goes up it will be necessary to do a part or all of the operations of making chain cables by machines. Because of the fact that we are looking ahead to the manufacture of sizes of cable larger than three inches, experiments have been made at the Boston yard to develop a machine process. Mr. Howard is present. He was the inspector of the chain made at the navy yard for the Panama Canal commission. I hope that he will take part in this discussion, and probably state the results obtained from his inspection; and if he is in a position to do so, to include in his discussion some of the notes from his report on these tests, which I think were rather interesting."

James E. Howard:—In regard to material, it occurs to me that the best results have commonly been obtained with puddled iron, of not too great a degree of refinement. When iron is refined to the extent of almost reaching the state of puddled steel, then I think there is danger of brittleness being introduced in the manufacture, and in the subsequent use of that iron that brittleness will manifest itself. The fabrication of material into the form of chains puts it into such a shape that there is not a very good distribution of stresses, and probably no chain is used that is not locally overstrained in some of its parts. The effect of overstraining is to cause a sort of accumulation of brittleness. That brings up an important question in regard to chain cable that we should consider, I think, and that is, while the original tests commonly break at the weld, we know that a great many links, after service, do not break there, but break elsewhere. Having a soft and tough fibrous iron at the outset, getting that by selection of material, we want to keep it so. The proving stress of a chain overstrains it in a degree. That starts, in the same ratio, to increase the elastic limit and tensile strength with increased ductility, so I think it is safe to anneal after proving stresses have been applied, and that annealing to be efficient at all times ought to be repeated. Whenever there is a known overstrain of the chain, it would be safe to repeat the annealing. In reference to the chain at the isthmus, that was a recommendation which was introduced, because the case there was so important—to stop a ship at the gates of the locks—that it would be prudent to anneal the fender chains after a severe shock had been received of that kind.

Years of Study

Richard M. Watt:—I simply wanted to add to this paper the fact that Mr. Otterson states that it represents several years of exhaustive study on this subject, and that in his capacity as assistant superintendent of the hull division of the navy yard at Boston, he has markedly improved the quality of the output of the chain at that yard, so that his efforts have resulted in the saving of many thousands of dollars to the government. I believe that that attention, which has so increased the hand output, will in time develop an entirely satisfactory method or process of power manufacture of chain.

Francis T. Bowles:—No doubt we are under many obligations to the author of this paper for the information he has given us, and I do not want to appear as too discriminating when I suggest that historical notes on the subject of chain cable are absolutely incomplete without any reference to the subject of swivels and shackles. My own interest in the subject of chain cable is entirely connected with those things which cannot be properly described in polite language.

More Ductile Material

John E. Otterson:—I think that the future development of the manufacture of chain, as regards the material, will probably be along the lines suggested by Mr. Howard, and that we will go into larger sizes to the use of a softer and more ductile material. We have recently received a shipment of material of this character, and while in the straight specimen it gave rather low test, yet when formed into links the tests were very satisfactory, the probability being that the ductile material under deflection flowed more readily and subjected itself to less strains than the harder and more brittle material. I might say, with the process developed to its present form, and the links turned over to the chainmakers, that it will be possible for them to increase the output 100 per cent or more. I do not say they will increase it, we will probably have difficulty in making them do it, but it is possible for them to increase it. In regard to the remarks of Admiral Bowles, as to the question of shackles and swivels, I might say that discussion of those features has not been included in the paper for the reason that we have not had as much trouble with the manufacture of shackles and swivels as we have had in the manufacture of chains, and they are at present manufactured by machine processes. I feel that any troubles which have been experienced have been more in the testing of these appliances, and when they are put in service they are reliable.

Contract for the construction of a large ice breaking steamer for St. Lawrence river service has been awarded to Canadian Vickers, Ltd., Montreal, for $998,593. The steamer will be 292 ft. over all, 275 ft. between perpendiculars, 56 ft. molded beam and 32 ft. molded depth. The machinery will be imported from Ireland.

The Institution of Naval Architects will hold a summer meeting at Newcastle-on-Tyne, July 7-10.

Active Gyro Stabilizer

Elmer A. Sperry read his paper on "Some Graphic Studies of the Active Gyro Stabilizer", at the December meeting of the Society of Naval Architects and Marine Engineers.

This work was undertaken to verify some observations made in connection with the sea trials of the active gyro stabilizer, which time did not permit of reproducing, and also to pursue some investigations further than was possible at sea, where it was felt that the sea characteristics were only at best roughly estimated, and where, for the purposes of checking, their recurrence could not be secured. Again, a number of questions arose upon which more light was needed as to the exact behavior of the active gyro stabilizer, for instance, under widely varying phase relations of sea and ship, and also under widely varying conditions as to wave slope, general sea intensity, etc. In this way we have been enabled to verify, under conditions of much more extended observation, just what happens when the stabilizing capacity of the gyros is approached, exceeded and also far surpassed, and thus verify the results at sea.

Another important point is that with the new stabilizer no special problems whatever are introduced by the condition of synchronism or, in fact, any harmonic relation between the periods of the sea and ship.

Again, no small interest centers about the fact that with the active stabilizer no phenomena exists corresponding to the marked falling off in stabilizing capacity of damping tanks each side of the synchronous condition, nor is any phase relation possible between the waves and ship at which the active stabilizer is found to have the slightest tendency to add anything whatever to either the amplitude or the persistence of roll as do tanks.

It has been ascertained, also, that no alterations or adjustments of the gyro is necessary to fit changes in period of either sea or ship. The plant was found to work with equal reliability throughout the whole gamut of phase relation of wave slope and also under conditions of forced rolling.

Under the head of "Forced Rolling", that is, when the ship leaves her natural period and takes up the period of the sea, it is believed that never before has this interesting phenomena been studied where, for all practical purposes, the ship has been completely stabilized for all frequencies, and it is believed that an advance has been made in knowledge of forced rolling, and the conditions under which it invariably takes place.

The stabilizing efficiencies of the active model have been determined, confirming the high efficiencies observed in operating a full-sized plant at sea.

The unique action and dependability of the journals have also received confirmation.

The space and weight requirements, smallness of the power required, and the very low maximum stresses in the plant as well as in the ship in the vicinity of the plant have also received a valuable check.

The general reliability and simplicity of the system of velocity control has also received confirmation.

Mr. Sperry explained his paper at length, but it is impossible to report it without reference to the diagrams which, however will be given in the Transactions. During the course of his remarks Mr. Sperry said that at certain points in the phase relation between ships and wave anti-rolling tanks are positively dangerous. In reply to a question by H. C. Higgins as to how much space the stabilizer occupies he replied that it occupied only a small percentage of the space occupied by the tanks and weighed a little under 1 per cent of the ship's displacement. In reply to a question by E. L. M. Sivard on the influence of the stabilizer on the stresses of the ship he replied that there was virtually no stress.

Handling Shells With Coaling Capstans

Between three and four days time was saved in getting the battleship New York away from the navy yard in Brooklyn, when she was preparing to hurry off to Vera Cruz recently, by a novel use made of her deck capstans and coaling rig in getting aboard her ammunition for the 14-in. guns. This was possible because of the new control device invented by the Lidgerwood Mfg. Co. who built and installed the capstans. A set of deck capstans for independent coaling is a customary provision on battleships. They are arranged along both sides of the ship as in the case of the New York and are used to handle whip lines which run through blocks at the ends of spars footed near the rails and extending at an angle outboard so that the falls drop clear of the ship's side. The spars are footed a little out of line with the capstans so that they naturally swing around and bring their loads over the deck. The swinging of the spar is controlled by hand with lines running to the tops of the spars.

The capstans are driven by gears on two line shafts which run under the deck, one along each side of the ship. These shafts are driven by special twin engines. The line shafts run constantly when any of the capstans are in service. The capstans are so built that they can be picked up bodily and removed when the ship is cleared for action leaving the deck flush. Ordinarily they are arranged to be individually disconnected from the gears by means of a separate hand wheel for each so that any one of them can be stopped to prevent accident or for other purposes. When the installation of the coaling capstans for the New York was being considered the navy department required a more efficient method of control. The Lidgerwood Mfg. Co. undertook to meet this demand.

The capstans on the New York are controlled by a foot pedal beside the foot of the capstan. A slight pressure of the foot instantly and positively connects the gears and a similar light pressure on a catch beside the pedal releases the button and automatically puts the capstan into action. The real power for the connecting and disconnecting actions is secured from the line shaft by a very simple and ingenious mechanism.

This facility in connecting and disconnecting was what made it possible for the coaling apparatus of the New York to be used with safety in taking aboard such sensitive and dangerous ammunition as 14-in. shells. This work was done without accident and with perfect satisfaction to the naval authorities, although the shells weigh 1,400 lbs. and the coaling apparatus is intended for handling 800 lb. loads.

At a recent hearing to determine the advisability of using concrete for the immense new dry dock, forming part of Boston's port development, photographs of reinforced concrete piers, built by the Aberthaw Construction Co., in 1909, formed one of the determining features. These photographs showed that with proper mix and treatment the combined chemical and frost action of sea water could be neutralized even when the material was subjected to alternate immersion in the water and exposure to the air. The decision was to build of reinforced concrete with wearing surfaces or altars of granite.